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THE PREVENTION AND TREATMENT OF HAY FEVER.

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The records of the American Hay Fever Association indicate that the victims of hay fever in the United States number over a million, and that the number is steadily increasing, both apparently and actually. The apparent increase is due to the fact that many cases of hay fever, especially those occurring outside of the most common fall season and formerly classified as "summer colds," "rhinitis," "recurrent catarrh" etc., are now more generally recognized as hay fever.[1] The increase is also real, as the increase in facilities of transportation, by means of autos and trolley cars, has resulted in an increase in the development of suburban settlements, practically all of which are more or less directly exposed to pollen infestation.

In view of the importance of hay fever, as regards both the large numbers affected and the length and severity of the symptoms, the treatment of this disease demands a most careful consideration.

Preventive Measures.

In the selection of homes, hay fever subjects should choose localities distant from weed-infested areas. The pollen of the grasses, and of the summer hay fever weeds generally, does not ordinarily travel very far, and a mile is usually a safe distance. The pollen of the ragweeds and other fall hay fever weeds, however, is very buoyant, and in windy weather may travel five miles or more.

The effects of tree pollens should also be borne in mind by persons subject to hay fever. There is a large list of harmless trees to select from in planting shade and ornamental trees in the immediate vicinity of the home, so that hay fever subjects need not jeopardize their comfort by surrounding themselves with trees with hay fever pollens. Practically all fruit trees, trees bearing attractive flowers and the pines are harmless from a hay fever standpoint. Vines growing on the house and trellis are also usually harmless.

The Japanese clematis (*Clematis paniculata*) and the virgin's bower (*Clematis virginiana*), however, have a hay fever pollen, and,

[1] Scheppegrell: Hay fever and asthma: Cause, prevention, and cure. Lea & Febriger, 1922.

although insect pollinated, have such a profusion of bloom that the wind may dislodge sufficient pollen to cause mild hay fever symptoms in sensitive subjects. In view of the large number of persons in the United States afflicted with hay fever, the subject of trees and plants from a hay fever standpoint should be given due consideration by the modern landscape architects.

During their attacks of hay fever, patients should avoid localities infested with weeds generally, and especially with those weeds to the pollen of which they are sensitive. Should their neighborhood be infested with weeds, and an ordinance be in force prohibiting such a condition, it should, in the interest of public health, be reported to the board of health.

During hay fever season, patients should avoid driving or riding into suburbs abounding in weeds. An attack resulting from this increased exposure may lower their resistance and make them more susceptible to the pollen of their own neighborhood.

Electric fans should be avoided during the hay fever season, as the chilling of the surface of the skin tends to react on the mucous membrane of the nose, and in this way to increase the nasal irritation. In addition to this, the current of air from the fans disturbs the dust, which contains its proportion of pollen during the hay fever season, the inhalation of which increases the discomfort of the patient.

Hay fever subjects are frequently surprised that their symptoms are aggravated in theaters, where they expected protection from atmospheric pollens. The reason is that modern amusement halls operating in summer are practically all supplied with typhoon fans. These draw in the pollen-laden air in enormous quantities, and force it into the auditorium, where the effect is quickly felt by those sensitive to these pollens. Such places of amusement should, therefore, be avoided by unimmunized hay fever subjects during the season of their attacks.

A reasonable amount of exercise is beneficial; but this should be taken without increased exposure to the hay fever pollens. Swimming, especially in salt water, is an excellent form of exercise.

A cold shower after a warm bath is an excellent means of toning the skin and stimulating the nervous system in hay-fever cases. The regular practice of this makes the patient less sensitive to changes of temperature and to air currents which tend to increase the nasal irritation in these cases. The cold showers should be followed by a vigorous rubbing, and are beneficial in all cases except when the patient fails to react from the showers, and when they are contraindicated on account of high blood pressure or other reasons.

One of the recognized methods of preventing hay fever is that of passing the hay-fever season in some locality in which the patient finds relief. This is especially the case with the fall hay fever, when

thousands of hay-fever subjects sojourn to the so-called hay-fever resorts. Many persons who suffer from the spring hay fever also obtain benefit in this way. It is not always necessary, however, to travel long distances to obtain relief from the spring hay fever. In many cases we have simply advised patients to move temporarily to a more central portion of the city for the hay-fever season, and this has been found to give them entire relief.

It must be understood, in this connection, that while persons not subject to hay fever can inhale large numbers of pollen without perceptible effect, even hay-fever subjects can inhale a certain number without discomfort, the number varying with the degree of susceptibility of the patient. On this account, the decreased number of hay-fever pollens that are found in the more densely populated portion of the city is not sufficient to produce the hay-fever attacks in these cases.

Before making a change of residence, with a view of obtaining benefit in hay fever, especially if the change is to be permanent, the patient should consult a physician familiar with the etiology of hay fever. Unless this is the case, not only may the result be disappointing, but the conditions may even be aggravated. This is illustrated in the case of a fall hay-fever subject in Florida, who, having heard that the mountains furnish relief from hay fever, bought a beautiful home in northwestern North Carolina. Mountains, however, to be of benefit must have an altitude too great for the growth of hay-fever weeds, which is rarely less than 6,000 feet. This section of North Carolina (altitude, 2,250 feet) has a shorter fall hay-fever season than most sections of the Southern States, but it makes up for this by its greater activity due to the profuse pollination of the common ragweeds which infest this portion of the State. The patient realized this the first season and soon departed, wiser from her experience.

Railroad trips during the hay-fever season should, if possible, be avoided by hay-fever patients, as they usually cause severe attacks. This is due to the fact that the right of ways of most railroads are lined with hay-fever weeds, and their pollen is drawn into the cars with the vortex of air created by the rapidly moving cars. The action of the pollen is usually aggravated by the dust and the products of the coal combustion, and the resulting paroxysms are usually quite severe.

It is not uncommon that a railroad trip of an hour or two will develop an attack of hay fever lasting 10 to 15 hours. The effect of such trips is an especial hardship on commuters, traveling salesmen, conductors of trains, and others who are compelled to travel during the hay-fever seasons; and the railroad officials should therefore be urged, in the interests of public health as well as for commercial reasons, to keep their right of ways free of hay-fever weeds.

In a railroad trip some protection is afforded by breathing through a moist handkerchief, or placing some aseptic wool within the nostrils. Afterwards the nostrils should be irrigated with a warm one-half of 1 per cent saline solution. One-half teaspoonful of table salt dissolved in 1 pint of warm water, and the solution drawn into the nostrils from an agate bowl, will usually answer the purpose. The solution should be expelled gently from the nostrils, so as to avoid forcing it into the Eustachian tubes.

DIET

The diet of hay-fever subjects during the hay-fever season should be light as regards food rich in protein, such as meat, fish, eggs, cheese, and milk. Farinaceous food may be taken in moderation. Vegetables are of benefit, and also fruit.

High seasoning especially should be avoided, as it frequently reacts on the membranes of the nostrils already irritated by the pollen. Alcoholic drinks are injurious.

In cases complicated by asthma, the rules regarding diet should be carefully observed, and it is preferable in these cases to have the principal meal during the middle of the day.

There are certain articles of food that should be avoided in cases complicated by asthma, in the perennial form of hay fever, and in seasonal cases failing to be relieved by the indicated pollen treatment. The foods to be avoided in these cases should be determined by the diagnostic skin tests. In one case, for instance, an attack of hay fever could be aggravated by a piece of watermelon, in another by peaches.

SURGICAL METHODS.

While abnormal nasal conditions in their relation to hay fever have been given undue importance by some rhinologists, they should, nevertheless, be given careful consideration as forming a predisposing factor in hay fever. In fact, any condition which tends to develop a hypersensitiveness of the nasal mucosa predisposes the patient to an incipient sensitization which may result in a persistent form of hay fever.

Marked septal spurs, ridges, or deflections, which cause a concentration of pollen in the obstructed nostril, or which touch the opposite turbinal and thus cause irritation, congestion, and hypersensitiveness, may form an important predisposing cause. Infection of the sinuses, especially of the ethmoidal cells, should receive careful attention. While the percentage of cures from operations in these cases is not high (7 per cent), they should not be overlooked in the prophylaxis of hay fever.

Nasal surgery in hay fever, however, should be avoided, except in such conditions as indicated above. In other cases operations are

unnecessary inflictions on the patient and are without benefit. One of our patients, a physician, had both inferior turbinates cauterized and then removed and the right ethmoidal cells eviscerated without benefit, and the surgeon had advised a similar operation on the left side. Another patient had nine operations performed, including several electrocauterizations, without perceptible benefit to his hay fever. These cases indicate not only the futility of excessive surgery, but also the distressing character of a disease that would cause the patient to submit to these repeated ordeals.

In hay fever electrocautery has probably been used more frequently than any other surgical method. It is based on the idea that in hay fever there is an intumescence of the inferior turbinals which the cicatricial contraction following the cauterization is intended to relieve. There are few cases, however, that have been benefited by this method, and we have seen many patients who claim that their condition was aggravated by the cauterization, and some even who claimed that this was the original cause of their attacks. In view of these facts, electrocauterization should be avoided in hay fever.

In a series of 2,000 cases (series C, D, and E) treated in the hay fever clinic of the Charity Hospital and in private practice, 8 per cent had been operated on for hay fever without apparent benefit.

Immunization.

Hay fever is now recognized as being an allergic disease, the most common cause being the protein of atmospheric pollen. In the seasonal form of hay fever the pollens are usually the sole cause, the attacks being synchronous with the prevalence of the pollen to which the patient is sensitive. In the perennial form of hay fever, however, the patients are usually sensitive to the pollens causing the spring, summer, and fall hay fever, and in addition to the protein of epidermal or other material inhaled, absorbed, or ingested which tends to continue the attacks during the intermission of the atmospheric pollen periods.

In view of the allergic cause of hay fever, the modern method of treatment is to develop immunity to the protein causing the attacks, or to eliminate it, if this is practicable. If a food protein is one of the causes, the elimination is simple; but in the case of pollen this can be accomplished only by a change, during the hay fever season, to a locality in which the offending pollen is not found. In both of these cases, however, the benefit lasts only during the absence of the allergic protein, and no immunity is conferred on the patient.

The most successful results in the treatment of hay fever have been obtained by the scientific use of pollen extracts, suitable vaccines being used in some cases to meet complications.

DIAGNOSTIC TESTS.

In all cases in which pollen extracts are used, the diagnostic tests should be applied in order to determine the character and degree of the hay fever reaction. These tests may be cutaneous or intradermal.

In the cutaneous test, the skin of the forearm, sterilized by alcohol, is first scarified by means of a linear scratch one-eighth of an inch in length, and a drop of the pollen extract, 1,000 units to 1 c. c., applied. This method can be used at any season, but lacks the accuracy of the intradermal test, and is also less reliable than the intradermal method as regards the degree of the patient's susceptibility to the pollen protein. In the intradermal test, 5 units of the pollen extract (0.05 c. c. of the 100 units to 1 c. c.) is injected into (not under) the skin of the forearm. A site should be selected free from sunburn or tan, so that the effect may be observed, and the injections made 1 inch apart, so as to show the contrast of the tests.

In both forms of tests, positive reactions are indicated by an urticarial wheal surrounded by a circle of hyperemia, which develops in 30 minutes. The degree of sensitiveness of the patient to the pollen is indicated by the size of the wheal, which varies from 0.3 to 2.5 cm. or more in diameter, and by the degree of the surrounding hyperemia. In most cases three tests, as, for instance, a test of the grass, of the chenopod, and of the ragweed groups,[2] are made at one time, so that the reaction may be compared. An injection or application of the diluent only should be used as a check on these tests.

The tests should be made with the usual precautions regarding asepsis. Alcohol is used for sterilizing the skin of the patient, as the stain of iodine obscures the appearance of the reaction. In thousands of tests there has been no case of infection from our use of the pollen extracts.

Three tests only should be made at one time, each being of a different pollen group. It rarely happens that a patient has a maximum reaction to each of these, and the possibility of a severe reaction from each is remote. If two or more of the tests, however, are of the same group, and each test develops a maximum reaction, the patient may suffer a severe anaphalaxis either local or general, or both. In one of our cases, in which the short stay of the patient in New Orleans necessitated an increase in the number of tests, the patient developed a reaction from which the arm was swollen to twice the normal size, the pain extending to the shoulder, and he experienced chilly sensations and passed a sleepless night. It was three days before the arm resumed its normal size, and an intense itching of the arm persisted for several days longer. In another case, under

[2] Loc. cit.

similar circumstances, a severe attack of hay fever developed in 30 minutes, in spite of the fact that it was not the usual hay fever season of the patient.

These cases illustrate not only the necessity for conservatism in making these tests, but still more the importance of making the diagnostic tests before any pollen extract is injected hypodermatically. As the extract in the above cited cases was injected into the skin, and thence gradually absorbed by the system, the danger was not great. Had the injection been made under the skin, however, permitting a rapid absorption of the proteins, the patient might have been overwhelmed by the anaphalactic shock.

ATYPICAL FORMS OF SENSITIZATION.

There is a relatively small percentage of hay fever and asthma cases, usually of the perennial form, due to the inhalation of the dandruff protein of horses and other animals. Formerly, when the driving of horses for pleasure or business was common, the sensitization from these animals was not infrequent, especially as horses and mules were used for passenger transportation. In this age of motor vehicles, this form of hay fever and asthma is uncommon.

During our service in the World War, however, we found a number of men in the Cavalry and Artillery who developed hay fever or asthma from inhaling the dandruff of horses. In the majority of these cases no effort was made to immunize against these emanations, but the recommendation was made that the men be transferred to the Infantry branch of the service, where they would not be exposed to the inhalation of this protein.

Hay fever and asthma is sometimes due to the dust of feathers, and the possibility of this source of infection should be considered in the diagnostic tests, especially in the perennial form of these diseases. Feathers are commonly used for pillows, and if the patient is found sensitive to feathers, it is usually preferable to use pillows filled with cotton, moss, or other material, rather than to immunize the patient against the feathers.

The dust of wool should also be considered as an etiologic factor in the perennial forms of hay fever and asthma, as the wool in blankets, clothing, rugs, etc., may be the cause. We have had a number of cases of feathers and of wool sensitization which were relieved by avoidance of these materials. The protein of the hair or skin dust of dogs and cats and other fur-bearing animals and of fur wearing apparel may be the cause. The influence of these proteins should be determined by the diagnostic tests.

There are cases also in which the attacks are caused by the dust protein of coffee, flour, and similar material. In one of our hay-

fever cases in which the patient was sensitive to the ragweed and grass pollen, irregular attacks continued to develop at different seasons of the year after he had been immunized to both of these pollens. A series of cutaneous food tests showed a sensitivity to the dust of the coffee bean, and the fact was elicited that the patient occasionally visited a coffee storehouse which formed part of his business. For the past three years, he has avoided this storehouse, and he has had no hay fever during that time.

The inhalation of flour dust occasionally causes hay fever or asthma, and the possibility of this should be remembered, especially when the patient is engaged in an occupation in which he is exposed to this dust. We have made repeated tests for the dust of cotton in connection with hay fever and asthma, but these have all given negative results.

Atypical forms develop in some cases only when the pollens have already caused an attack of hay fever. We have patients, for instance, who, during their hay-fever season, are sensitive to the dander of horses and dogs, and to the dust of feathers, but are not inconvenienced by these proteins at other times. We have already noted [3] that fall hay-fever subjects gradually tend to have their attacks at an earlier date, and before their specific plants are in bloom, showing a tendency to develop sensitization to other pollens. In a similar manner these cases, while under the depressing influence of their hay fever, have a lowered resistance to the protein of animal emanations, to which at other times they are not sensitive.

A certain proportion of atypical cases of hay fever and asthma, especially of the perennial form, develop their attacks from articles of food. In all cases of the usual seasonal type, in which the attacks persist after the offending pollen has disappeared or decreased to a negligible amount, and in which the tests for epidermal substances, such as animal hairs and feathers and other protein dust, are negative, the cutaneous food tests should be made with a view of determining any article of diet that may have a causative relation to the attack.

Similar tests should also be made in cases, usually of the perennial type, in which the diagnostic tests for pollen and other inhaled material prove negative. In such cases, if the allergic food is determined, it should either be omitted from the diet, or reduced to a point where it is harmless. Should the article be necessary for the health of the patient, immunity can usually be developed by commencing with an innocuous amount, and gradually increasing the amount as tolerance is developed. Among the common articles which we have found to cause hay-fever attacks in such cases are fish, shellfish, meats,

[3] Loc. cit.

wheat flour, eggs, lettuce, Worcestershire sauce, and water melons. Walker[4] reports cases due to eating raw carrots, celery, and onions.

Another atypical form of hay fever and asthma in which all the tests for inhaled and ingested material are negative, is of bacterial origin. In these cases the absorbed protein of the secretions in the nasal or accessory cavities, teeth, or other localities, give rise to the characteristic hay-fever symptoms. Some of these cases may be determined by a careful examination, but this is not always successful, and in such cases the diagnostic tests should be made with the staphylococcic, streptococcic, or other forms of vaccines. In cases in which the treatment of the affected part is impracticable or fails to be effective, vaccines, preferably autogenous, should be administered.

POLLEN THERAPY.

After the character and degree of the sensitization have been determined, the immunizing treatment is commenced by injecting 5 or 10 units, according to the diagnostic tests, of the extract of the pollen to which the patient is sensitive, and to which he will be exposed. If he is sensitive, for instance, to the grass pollens, which are prevalent in the spring and early summer, this pollen extract is used for the spring injections. If the patient is sensitive to both grass and ragweed pollens, the immunizing treatment for the grass pollens is commenced six to eight weeks before the grass season opens, and for the ragweed pollens, the same length of time before the commencement of the ragweed season. We do not consider it practicable to use the combined pollens in these cases, on account of the great difference in the seasons of exposure, and the variation in the degree of sensitivity to these pollens.

The pollen extracts are injected into the arm at a sufficient distance above the elbow to avoid inconvenience of this joint in the event of an unusual local reaction. This rarely occurs, however, except when a vaccine is used for catarrhal complications. It is preferable to avoid the same site for more than one injection, as experiments have shown that repeated skin tests in the same place gradually show less reaction to the pollen protein.

In the injection of the pollen extracts, the reaction of the preceding dose is a guide to the increase in the number of units to be used. If it is found that an injection has caused a marked local reaction, the preceding dose should be repeated, and no increase should be attempted as long as there is an unusual reaction. This is especially important, when the injection causes an attack of hay fever, which invariably indicates that the conservative dose has been exceeded.

[4] I. C. Walker: Observations on hay fever. Annals of Otology, Rhinology, and Laryngology, September, 1922.

In immunizing for hay fever, no benefit is gained by increasing the dose of the pollen extract too rapidly; on the contrary, in addition to the inconvenience of the patient, it usually retards the benefit of the treatment.

VACCINE THERAPY.

While our experience has shown that pollen therapy is effective in the treatment of hay fever, there are cases in which this form of treatment alone does not give satisfactory results, especially during the active stage of the disease. In such cases the vaccines are substituted for the pollen extracts during the acute stage of the disease.

If the patient applies for treatment during an attack of hay fever, a vaccine should be used, this being injected at intervals of two or three days until the severity of the attack subsides. The pollen extract is then used, the vaccine injections being resumed if an attack of hay fever occurs.

Our reason for using the vaccine during severe paroxysms is that at this time the patient is suffering not only from the effects of the pollen protein, but also from the great increase in the pathogenic microorganisms resulting from the lowered resistance of the respiratory membrane. The autogenous vaccines give more definite results, provided they can be obtained of the proper standard and purity. When there is any doubt regarding this, the stock vaccines of unquestioned reliability should be given the preference.

In acute conditions, a stock vaccine is first used, as it is immediately available and is especially indicated if ear, throat, or sinus complications develop, and as prompt action is required. In chronic conditions, or when the patient fails to respond to stock vaccines, and especially in cases complicated with asthma and bronchitis, an autogenous vaccine is prepared. This is injected, instead of the pollen extract, until a sufficient amount of the vaccine has been administered.

Patients over 65 years of age do not react well to the administration of vaccine, either stock or autogenous, the injected material sometimes tending to form abscesses in spite of all precautions. The pollen extracts seem not to have this effect, and the treatment should be limited to these in such cases. The dose of the vaccine should be sufficiently large to cause a local reaction at the site of the injections, as benefit is obtained only when this is the case.

We use three principal stock vaccines, each containing 1,000 millions to the cubic centimeter in various proportions of the following microorganisms: Friedländer bacillus, *M. catarrhalis*, pneumococcus, *Streptococcus pyogenes*, and *Staphylococcus aureus* and *albus*.

IMMUNIZING DOSES.

The required dose of the pollen extract is controlled by the reaction in the diagnostic test, careful records of which should be kept for each patient. When the reaction has been marked, smaller doses are used, while in other cases the doses are increased proportionately.

Care should be exercised in the injections that the needle does not penetrate a subcutaneous vein, as the sudden entry of a considerable amount of the foreign protein may produce an anaphylactic shock in a patient sensitive to the protein. Active massage of the injected protein should also be avoided, as experimental injections of foreign proteins in animals have shown that the solution may be forced from the site of the injection through the lymphatics into the thoracic duct in sufficient amounts to produce serious anaphylactic disturbances.

In all cases the treatment is discontinued when the pollenometric records show that the atmospheric pollens responsible for the attack have disappeared.

Before this time, however, the treatment is discontinued when the report of the patient indicates the control of the hay fever. In discontinuing treatment, the injections are first made at longer intervals and then discontinued.

In preseasonal treatment the injections are continued until the skin reactions become negative, when the patient should be free from hay fever. If, however, the attacks develop, this does not indicate that the immunization was unsuccessful, but that the proteins of some other pollen or other substances have an etiological association in the attacks, and the cause of the multiple infection should be determined by other diagnostic tests.

If the treatment merges into the hay fever season of the patient, or, as is frequently the case, the patient does not apply until his season has commenced, the immunizing doses of the pollen extract should be one-half of the preseasonal doses, as the patient is already absorbing the atmospheric pollen proteins.

The immunizing treatment of hay fever is contraindicated in patients with advanced pulmonary tuberculosis, exophthalmic goiter, or cardio-renal disease.

CAUSES OF FAILURE.

In the immunizing treatment of hay fever the recognition of the difference between allergy and anaphylaxis is important.[5] In successful immunization absolute immunity is not established, but usually a restoration to the congenital allergic condition before the development of the special sensitization which resulted in the hay fever symptoms. Successfully immunized subjects should therefore be

[5] Scheppegrell: Hay fever and hay fever pollen. Arch. of Int. Med., June, 1917.

warned against excessive exposure to the hay fever pollens to which they are sensitive, as this may result in a renewed sensitization and necessitate a repetition of the immunizing treatment. The failure to observe this precaution is responsible for some cases of relapse after an apparent cure lasting for several seasons.

A common cause of failure in the immunizing treatment of hay fever is the indiscriminate use of pollen extracts. The fall hay fever is the most common form, and as the ragweeds are the chief cause of this form,[6] the ragweed pollen extract is frequently used by practitioners in all forms of hay fever.

Another cause of failure, even in cases in which a scientific selection of the proper pollen extract is made, is the lack of judgment regarding the size of the progressive immunizing doses. Where these doses are already prepared, and are injected without regard to the relative sensitivity of the patient, as evidenced by the diagnostic tests, this liability to disappointing results is common.

It will be seen, therefore, that the physician employing immunological methods in hay fever has a much more complicated proposition than obtains in similar methods in other diseases in which the cause is usually limited to a single microorganism and its toxins. Unless he is prepared to follow up the various forms of immunization, both in the tests and treatments, his successful results will necessarily be limited.

ADSORPTION BY ALUMINIUM HYDRATE CONSIDERED AS A SOLID SOLUTION PHENOMENON.[a]

By Lewis B. Miller, Associate Chemist, Hygienic Laboratory, United States Public Health Service.

The term "adsorption" is used to describe a wide variety of phenomena. Most often it refers to an increased concentration of gas, vapor, liquid, solute, colloid, or suspended material on or in a solid body. To express quantitatively the results obtained in the study of these phenomena, a variety of mathematical formulae have been devised, most of which are of an empirical nature. Of these the Freundlich adsorption isotherm is one of the oldest and most widely applied:

$$\frac{x}{m} = KC^{\frac{1}{n}}$$

where x is the amount of material adsorbed; m, the mass of the adsorbent; C, the concentration of the material being adsorbed in the media surrounding the adsorbent; K and $\frac{1}{n}$, characteristic constants for each system.

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[6] Scheppegrell: The seasons, causes, and geographical distribution of hay fever, and hay fever resorts in the United States. Pub. Health Rep., Sept. 24, 1920. Reprint No. 610.

[a] Read in abstract before the spring meeting of the American Chemical Society, Washington, D. C., April 21-26, 1924.

This formula gives no indication as to what the mechanism of adsorption may be. It should be of interest and importance, therefore, to find the relation of the adsorption isotherm to equations governing "adsorption" in which something of the mechanism of the process is known.

Let us first consider the Gibbs' equation for surface concentration effects as related to surface tension. This equation deals with the phenomena manifested at the interface between two phases.

The equation is:

$$E = -\frac{C}{RT}\frac{d\gamma}{dc}$$

where E, is the excess concentration of solute in the surface layer; C, the concentration of solute in the bulk of solution; R and T have their usual significance; $\frac{d\gamma}{dc}$ is the change of surface tension, γ, with chance of concentration, c.

By a proper choice of units the term E may be expressed as amount of dissolved material x adsorbed on area a. If the system is so chosen as to make the adsorbent a solid material consisting of particles of uniform size, the area a is proportional to mass of adsorbent m. For a definite temperature the term RT becomes a constant, and, within narrow limits of concentration, at least, the term $\frac{d\gamma}{dc}$ approaches constancy.

Substituting these values in the Gibbs's equation, we have

$$\frac{x}{m} = \frac{C}{K_1}K_2$$

Collecting constants we have

$$\frac{x}{m} = KC,$$

which is Freundlich's adsorption isotherm.

There are various serious objections to the application of the Gibbs's equation to adsorption by solid bodies. For example, the systems are ordinarily not so dilute as to permit the application of the "gas laws for dilute solutions," which are implicit in the Gibbs's equation; nor are the adsorptions thermodynamically reversible (see Lewis, 1920). Furthermore, while the concentration or adsorption effects can be measured, the interfacial tension between solid and liquid phases does not lend itself to direct measurement. In the above transformation the application of the Gibbs's equation to such systems has been assumed.

Among colloid chemists there is increasing adherence to the idea that many "adsorption" phenomena can be explained on a purely

chemical basis. As examples of this tendency we may cite the following: Michaelis and Roma (1919) showed that in the case of adsorption of electrolyte by charcoal there is an equivalent exchange of electrolyte impurities already present in the charcoal for the electrolyte adsorbed. Glassner and Suida (1908) found that this exchange is between the adsorbed electrolyte and a cyanogen derivative in the charcoal. Kolthoff (1921) has shown that the adsorption of dyes by filter paper is a function of the ash content of the paper. A variety of further evidence might be added to indicate that, in certain cases at least, adsorption has many of the characteristics of a purly chemical reaction. (See also Langmuir (1916) and E. C. Sullivan (1907.)

Kolthoff (1922) found that those adsorptions which appear to be purely chemical in character can be expressed by the Freundlich adsorption isotherm. It is, therefore, necessary to derive the isotherm by the aid of stoichiometry. He does this as follows: To start with a simple case, let us shake a slightly soluble salt AB with a solution containing C ions which is capable of forming the slightly soluble compound AC. For example, let AgBr be shaken with a solution of thiocyanate. The reaction is as follows:

$$AgBr + C\bar{N}S \rightleftarrows AgCNS + B\bar{r}$$

If KAgBr and KAgCNS are the solubility products, respectively, of AgBr and AgCNS, then the concentration of silver ion is

$$[\overset{+}{Ag}] = \frac{K\text{AgBr}}{[Br]^-} = \frac{K\text{AgCNS}}{[CNS]^-}$$

From this equation it follows that

$$[B\bar{r}] = \frac{K\text{AgBr}}{K\text{AgCNS}} \cdot [C\bar{N}S] = K_1\,[C\bar{N}S]$$

Now $[B\bar{r}]$ is equal to the quantity of bromide ion which went into solution and is therefore equivalent to the quantity of thiocyanate ion taken out of solution. This is equal to $\frac{x}{m}$, and the concentration of thiocyanate ion $[C\bar{N}S]$ remaining in solution is equal to the final concentration, C.

Substituting in the above equation we have

$$\frac{x}{m} = K_1 C$$

Simularly for the displacement of a divalent ion by two monovalent ions as, for example, in the reaction

$$Ag_2SO_4 + 2\overline{Cl} \rightleftarrows 2AgCl + \overline{\overline{SO_4}}$$

we have

$$\frac{x}{m} = K_1 C^2;$$

and, likewise for the general case,

$$a\ A_xB_y + bC \rightleftarrows d\ A_pC_z + yB$$

we have

$$\frac{x}{m} = KC^{\frac{1}{n}}$$

where the magnitude of the coefficient K depends upon the ratio of the solubility products of the slightly soluble compounds and the exponent $\frac{1}{n}$ depends upon the valence of the reacting ions. Data are given showing the application of this formula to the adsorption of ions of different valence.

A difficulty inherent in this derivation is pointed out by Kolthoff. The proportion of the mixed solids present has no function, since the amount of electrolyte which will be adsorbed depends only upon the amount in solution, the valences, and solubility products. In most cases of adsorption the adsorbent is present in by far the greater proportion, and the amount of material already adsorbed is of importance in determining how much more may be adsorbed. To explain this, Kolthoff turns to the surface charge of the particle. The charge, he says, is due to the particular ions situated on the surface. There is a definite chemical affinity between the solid particle and the ion on its surface, the ion being one which the solid particle itself can form or one with which the solid particle can form a complex.

It is these surface ions on the particle only which can react in adsorption. Since it is only the surface layer which can react, a condition of saturation of the surface for adsorbed material can be realized. From this point of view it is plain why the ratio of the two solids present is of importance.

In his derivation Kolthoff uses the solubility products of the substance in question to determine the constant, K, of his equation

$$\frac{x}{m} = KC^{\frac{1}{n}}$$

It might be pointed out here that in case the two solids, AB and AC, form a solid solution, it is improbable that the solubility products of

these substances would remain constant, since the solubility product derivation is based upon the constancy of concentration of the solid phase. Also in the case of solid solution formation the constant, K, becomes a distribution coefficient between solid and liquid solutions. That this distribution coefficient would be identical with the ratio of the solubility products is doubtful. The two cases are, of course, entirely different, since Kolthoff considers that he is dealing with a three-phase system consisting of two solid phases and one liquid phase. In case of solid solution formation (assuming the miscibility of the components of the solid phase over the range of composition under consideration), there is formed a two-phase system, consisting of one liquid and one solid phase.

The Freundlich adsorption isotherm can easily be shown to be a form of the equation for a distribution between two phases. The term $\frac{x}{m}$ represents the amount of material "x" adsorbed by a quantity of adsorbent "m." By properly chosen units this becomes the concentration "C," in the solid phase. "C" of the equation is the concentration in solution. We then have:

$$C_1 = KC^{\frac{1}{n}}$$

For the distribution equation we have

$$C_1 = KC^{\alpha}$$

where C_1, and C, represent concentration of the substance in each of the phases. K and α are characteristic constants for each different system. The two equations are quite plainly of the same type.

The equation for distribution between two phases is known to apply when the two phases consist of immiscible liquids.

Meyer (1923) has applied the distribution equation to the equilibrium between a solid solution of paradibrombenzene and paradichlorbenzene and their solution in water, and has found that such system also conform to the equation.

In the study of base exchange in permutits (see Hisschemoller, 1921; Rothmund and Kronfeld, 1918; Whiteborn, 1923), it is generally agreed that a reaction of the type

$$NH_4^+ + NaP \rightleftarrows NH_4P + Na^+$$

takes place. The solid permutit behaves as one phase; that is, there is solid solution formation between the sodium permutit and the ammonium (or other) permutit. The expression for equilibrium takes the general form

$$\frac{[NH_4^+]}{[Na^+]}\ \text{solution} = K_1 \frac{[NH_4P]}{[NaP]}\ \text{solid},$$

the bracketed symbols representing concentration values. It is quite evident that this is of the form of a distribution equilibrium and

$$K_2[NH_4] = [NH_4P]$$

A series of studies (see Kuster, 1898; Kuster and Thiel, 1902; Thiel, 1900; Ramann and Sallinger, 1921; and Meyer, 1923) have been made of equilibrium conditions in precipitation reactions. These results were of the type in which each of two soluble salts react with a third salt, which is added in comparatively small amounts, to form an insoluble product. Analysis of the solution and solid phase followed. The results are of two kinds. Systems in which each of the insoluble products come down as a pure solid phase are characterized by certain phenomena. Let us consider a system of this type. If to a solution of K_2CO_3 and K_2SO_4 is added $BaCl_2$ the reaction which occurs depends upon the relative concentrations of $\overline{\overline{CO}}_3$:$\overline{\overline{SO}}_4$. For equilibrium with both solid phases present we have—

$$BaCO_3 + \overline{\overline{SO}}_4 \rightleftarrows BaSO_4 + \overline{\overline{CO}}_3$$

Suppose the ratio of $\frac{\overline{\overline{CO}}_3}{\overline{\overline{SO}}_4}$ is greater than the ratio determined by the equilibrium equation. Then pure $BaCO_3$ is first precipitated. By further addition of $BaCl_2$ a point will be reached where this equilibrium ratio is realized and $BaCO_3$ and $BaSO_4$ will be precipitated together. If the concentration of sulphate is relatively high, so that the ratio $\frac{\overline{\overline{CO}}_3}{\overline{\overline{SO}}_4}$ in solution is below that demanded for equilibrium, pure $BaSO_4$ will be first precipitated alone. However, so long as both solid phases are present (and the system is at equilibrium) the ratio of $\frac{\overline{\overline{CO}}_3}{\overline{\overline{SO}}_4}$ in solution will be a constant.

The other type of precipitation reaction is that in which the insoluble products do not come down each in the pure state but where they form mixed crystals or solid solution. Such a system is realized when $AgNO_3$ is added to a mixture of KCl and KBr in solution. Such

a system is characterized by the fact that as the solution phase is varied from 100 per cent KCl to 100 per cent KBr the solid phase shows a proportional variation. If the molar ratio $\frac{\frac{KBr}{KCl}}{\frac{AgBr}{AgCl}}$ be determined, or $\frac{\text{molecular per cent KBr}}{\text{molecular per cent AgBr}}$, we find that it yields a constant. This constant must be of the nature of a partition coefficient between liquid and solid solution. As we have seen, such an equilibrium may be expressed by the adsorption isotherm. It may be pointed out that while one may speak of adsorption of bromide by silver chloride at one end of the precipitation series and of adsorption of chloride by silver bromide at the other end, one may hardly use the term "adsorption" in its usual sense for a 50-50 mixture of the two solid components. Yet this system possesses the characteristics of "adsorption" and obeys the "adsorption equation."

Ashley (1913) has pointed out that it is possible to express by such an equation as the adsorption isotherm, with properly chosen constants, almost any series of observations with a fair degree of accuracy, provided only that the quantities in question change continuously in one direction—a condition which is fulfilled in a large number of series of experimental results.

It has been the purpose of the paper thus far to emphasize the fact that the Freundlich adsorption isotherm indicates nothing of the mechanism of adsorption. It has been shown that the isotherm may express "adsorption" of a purely physical nature, that it may express a chemical reaction of a certain kind occurring on the surface of a solid particle, that it may express distribution between two phases. It has been shown to be applicable to base exchange in permutits and to solid solution formation in precipitates, both of which probably involve both a chemical reaction and a distribution effect. While the types of phenomena cited do not include all the phenomena to which the term "adsorption" has been applied, yet they do emphasize the generality of that term and the wide applicability of the adsorption isotherm. They also indicate that in limited cases the mechanism of adsorption phenomena may be determined.

In a previous article (Miller, 1923) it has been shown that when alum is treated by less than the quantity of sodium hydroxide necessary to react according to the equation

$$Al^{+++} + 3\overline{O}H \rightleftarrows Al(OH)_3$$

there is sulphate carried down in the precipitate, which is not removed by washing with distilled water. The relative amount of sulphate

carried down is a function of the quantity of sodium hydroxide added to a given quantity of alum (the smaller the proportion of sodium hydroxide added the greater the proportion of sulphate in the precipitate), and is also therefore a function of the hydrogen ion concentration of the solution. Preliminary experiments indicated that the sulphate ion was rather easily displaced from the precipitate by other negative radicals. Two publications by Charriou in 1923 confirmed this idea. Charriou found that divalent negative ions carried down by the aluminium precipitate are removed by washing with solutions containing negative ions of equal or greater valence but not by monovalent ions. Similarly trivalent ions are removable by those of equal valence but not by those of lesser. He showed also that the phenomenon involved a displacement reaction, for, as one negative ion is removed from the precipitate, the ion causing the removal is taken up. He does not, in his articles, discuss the removal of monovalent negative ions. My own experiments published in a former article (1923) indicate that, working with dilute solutions, the presence of monovalent negative ions (other than hydroxyl) in the precipitate can not be directly demonstrated, although there is indirect evidence that they are carried out similarly to sulphate. If, for example, aluminium chloride is treated by sodium hydroxide and an attempt is made to wash the precipitate free from contaminating electrolyte, the precipitate disperses completely.

The observations of Charriou were extended to the adsorption of dyes by the washed alum precipitate containing sulphate. It was found that basic dyes were adsorbed little. In general, acid dyes containing only one strongly acid group (e. g., methyl red) were taken up little. On the other hand, dyes containing two or more acid groups (e. g., di, tri, and tetra potassium sulphonates of indigo) were taken up readily by shaking with the washed precipitate while at the same time sulphate was displaced.

These facts led to a quantitative study of the displacement of one ion from the precipitate by another. For this purpose the sulphate-oxalate system was chosen. It was first proposed to precipitate the aluminium floc in a solution containing relatively large proportions of potassium sulphate and potassium oxalate, the composition being varied from 100 per cent sulphate to 100 per cent oxalate. To do this it was necessary to introduce the aluminium in the form of a third salt, such as aluminium chloride. As a preliminary step, therefore, it was necessary to determine exactly the effect of the monovalent chloride ion on the composition of the precipitate in respect to its divalent ion content. Solutions of alum 0.005 molar with respect to Al were precipitated by slow addition of sodium

hydroxide in the presence of varying concentrations of potassium chloride. The composition of the floc was determined after washing free of contaminating electrolyte (see Miller, 1923) and the results were expressed as the molar ratio of $\frac{SO_4}{Al}$. In all experiments to follow, only highly purified materials were used, and every effort was made to make all parts of the procedure as accurate, quantitatively, as possible. The pH was determined colorimetrically, the sulphate gravimetrically as $BaSO_4$, and alumina as Al_2O_3 by Blum's (1916) method. Chloride was tested for by silver nitrate in nitric acid solution. The results are tabulated in Table 1.

TABLE 1.

Mols of NaOH added per mol of Al.	Mols of KCl added per mol of Al.	Molar ratio $\frac{SO_4}{Al}$ in precipitate.	pH.
2.0	0	0.2787	4.7
2.0	3	.2545	4.7
2.0	30	.2314	4.3
2.75	0	.0876	7.8
2.75	3	.0874	7.7
2.75	30	.0761	7.9

The presence of chloride in the washed precipitate was never detected, although a slight decrease in the sulphate content of the floc indicates a possible slight displacement of sulphate by chloride.

The effect of the presence of chloride ion is seen to be relatively small in changing the composition of the floc from alum. Since a definite quantity of $AlCl_3$ was used in the experiments which are to follow, it was assumed that the chloride ion present had a constant and small effect which could then be disregarded.

In the following experiments the floc was precipitated by slowly mixing $AlCl_3$ and NaOH in the presence of relatively large amounts of sulphate and oxalate. The solutions were mechanically stirred during the process. The concentration of $AlCl_3$ was 0.02 molar. There were added 2.4 molecules of NaOH per molecule of $AlCl_3$. The sum of the concentrations of $K_2SO_4 + K_2C_2O_4$ was 0.1 molar. The pH of the solution was determined colorimetrically. The precipitate was washed as previously described (Miller, 1923), dried at 80° C., and ground in an agate mortar. One weighed portion was dissolved in hydrochloric acid, the sulphate determined gravimetrically as barium sulphate, and the aluminium as alumina by Blum's (1916) method. A second portion was dissolved in sulphuric acid, and the oxalate determined by titration with permanganate. Aliquot portions of

the solution were analyzed for sulphate and oxalate by the methods described above. The results are given in Table 2.

TABLE 2.

Experiment number.	Before precipitation.		At equilibrium after precipitation.							
	Molar concentrate K_2SO_4.	Molar concentrate $K_2C_2O_4$.	pH.	Molar ratio $\frac{SO_4}{Al}$ in precipitate.	Molar ratio $\frac{C_2O_4}{Al}$ in precipitate.	Sum of mols of $C_2O_4+SO_4$ per mol of Al in precipitate.	Mols per cent SO_4 in precipitate.[1]	Mols per cent SO_4 in solution.[1]	$\frac{KSO_4}{SO_4 \text{ solution}}$ / SO_4 precipitant.	$\frac{KC_2O_4}{C_2O_4 \text{ solution}}$ / C_2O_4 precipitant.
2	0	0.1000	8.8		0.1756	0.1756	0	0		
3	.0500	.0500	8.8	0.00038	.1815	.1819	0.043	52.70	1,220.0	0.473
11	.0650	.0350	8.3	.0116	.1800	.1916	6.080	68.17	11.2	.340
5	.0750	.0250	8.1	.0108	.1818	.1926	5.610	78.64	14.0	.226
6	.0875	.0125	7.2	.0100	.1636	.1736	5.748	91.54	16.0	.090
7	.0937	.0062	6.4	.0671	.1516	.2187	20.67	96.62	3.25	.049
8	.0969	.0031	5.6	.1555	.0821	.2376	65.62	98.45	1.50	.045
9	.0984	.0016	5.3	.2127	.0428	.2555	83.25	99.16	1.19	.048
10	.0992	.0008	5.1	.2389	.0225	.2614	91.39	99.62	1.09	.044
1	.1000	0	5.1	.2367		.2367	100.00	100.00		

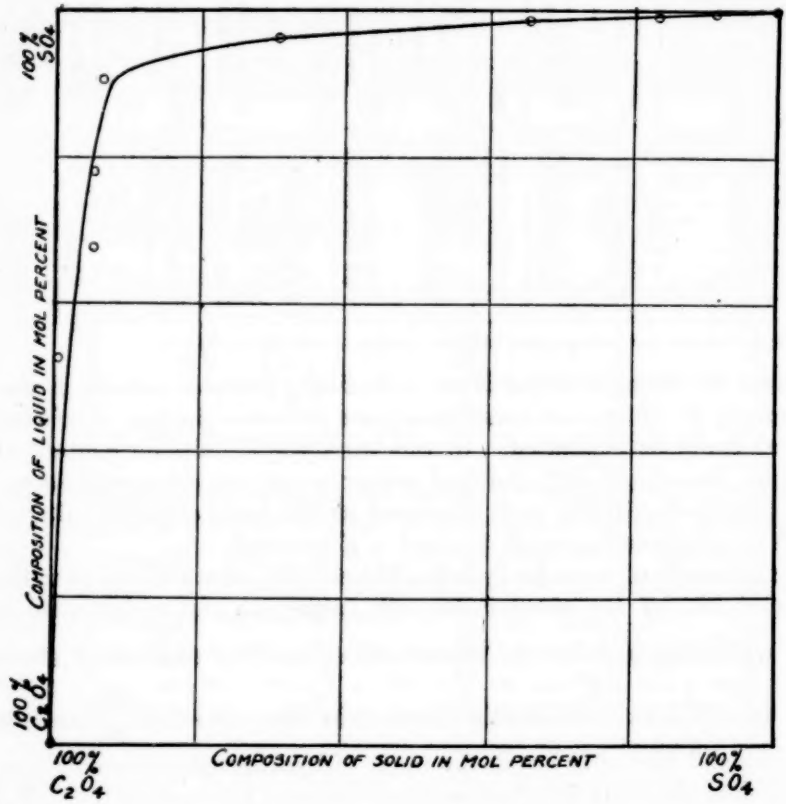
[1] The mol per cent is calculated on the basis that the sum of mols $C_2O_4+SO_4=100$.

Since the aluminium floc is an exceedingly complex system, it was necessary to choose one constituent as a reference against which the others could be evaluated. In this work the aluminium content of the floc was chosen as a point of reference and the concentrations of the other constituents were expressed as the ratio of the number of mols of constituent present per mol of aluminium.

In the study of the alum system (Miller, 1923) it was found that the composition of the precipitate with respect to the molar ratio of $\frac{SO_4}{Al}$ was constant from the lowest pH studied up to a pH of about 5.5. In solutions more alkaline than this, the ration of $\frac{SO_4}{Al}$ rapidly decreased. Hence it was in the range of hydrogen ion concentration more acid than pH 5.5 that best results were to be expected. The experimental results verified this hypothesis. The values of the constants, KSO_4 and KC_2O_4, are seen to be fairly constant over the more acid ranges. Furthermore, over the range in which the proportion of sulphate in the precipitate is very small, the ration of $\frac{SO_4}{Al}$ will be relatively inaccurate, due to the difficulties of determining accurately a small amount of sulphate under the existing conditions and the correspondingly important part played by experimental error. The values of the constant, KSO_4, will therefore be less trustworthy over this region.

The fact that the concentration of sulphate (or oxalate) in the solution divided by its concentration in the precipitate, expressed as

molecular per cent of the sulphate plus oxalate concentration, yields a constant, indicates that the precipitate is behaving as a single solid phase—a solid solution. The entire system behaves, then, as a two-phase system consisting of a liquid solution and a solid solution. (See articles by Kuster and Thiel.) The sulphate and oxalate ions behave as though distributed between these two solutions. The curve (Fig. 1) is typical of such a system.



From the table it will be noted that the sum of the number of mols of sulphate plus oxalate per mol of aluminium, is broadly speaking, constant. This indicates that in the precipitate these ions are reciprocally displacing each other. The decrease in their sum which occurs in passing from solutions high in sulphate concentration to solutions high in oxalate concentration is accompanied by a corresponding increase of pH. The effect of increase of pH in decreasing the sulphate content of the floc was indicated in my previous paper (1923). Presumably a similar phenomenon is occurring here, due perhaps to a slight hydrolysis of potassium oxalate. As has been pointed out, this change of hydrogen ion concentration

may also account, at least in part, for the drift in the distribution constants, KSO_4 and KC_2O_4.

In order to determine whether the equilibrium conditions just described could be realized only by a scheme of precipitation such as was used, or whether a condition of equilibrium could also be readily established by displacing one ion by another in a precipitate previously prepared, the following experiments were performed: A precipitate was prepared from alum and sodium hydroxide. This was washed and a portion was analyzed as usual (Miller, 1923). The remainder was divided into six portions and immersed in solutions containing varying proportions of K_2SO_4 and $K_2C_2O_4$. The samples were placed in glass-stoppered bottles and shaken from time to time for three days. The pH of the solutions was determined colorimetrically. The concentrations of sulphate and oxalate in the supernatant liquid and in the washed precipitate were determined as before. The results are given in Table 3.

TABLE 3.

Experiment number.	Before addition of floc.		After equilibrium.							
	Molar conc. K_2SO_4.	Molar conc. $K_2C_2O_4$.	pH.	Mol ratio $\frac{SO_4}{Al}$ in ppt.	Mol ratio $\frac{C_2O_4}{Al}$ in ppt.	Sum of mols $SO_4+C_2O_4$ per mol Al in ppt.	Mol per cent SO_4 in solution.[1]	Mol per cent SO_4 in ppt.[1]	$\frac{KSO_4\ sol'n.}{SO_4\ ppt.}$	$\frac{KC_2O_4\ sol'n.}{C_2O_4\ ppt.}$
Control			5.8	0.2883		0.2883				
21	0.0992	0.0008	5.7	.2620	0.0176	.2796	99.92	93.71	1.07	0.013
22	.0969	.0031	6.0	.2273	.0590	.2863	99.76	79.39	1.26	.012
23	.0937	.0062	6.4	.1509	.1228	.2737	99.44	55.14	1.80	.010
24	.0875	.0125	6.9	.0685	.1952	.2637	97.70	25.99	3.76	.031
25	.0750	.0250	7.9	.0320	.2143	.2463	92.07	12.98	7.08	.093
26	.0650	.0350	8.2	.0211	.2222	.2433	68.57	8.69	7.90	.343

[1] The mol per cent is calculated on the basis that the sum of mols $C_2O_4+SO_4=100$ per cent.

A comparison of the results in Tables 2 and 3, and especially a comparison of the distribution coefficients, will indicate that the system under consideration had come to equilibrium in three days. The same comments that were made upon Table 2 are again applicable here. It will also be observed that the displacement of the negative radicals (other than hydroxyl) is very similar to the base exchange in permutits. While the results are not as clean cut as have been obtained with permutits, it must be remembered that the system under consideration is a much less stable one than the permutit system.

It must be emphasized that the system under consideration is a most complex and sensitive one. In each series of experiments the details of procedure were carried out as precisely the same in each experiment as was possible. Nevertheless many of the possible

variables were not controlled. For example, the experiments were done at room temperature and no account was taken of small changes of temperature. What effect this may have had on the equilibrium is not known. The literature upon the subject indicates that the aluminium precipitate exhibits the phenomenon of "ageing." How rapidly this occurs, to what extent (if at all) it affects the composition of the alum floc, and whether the ageing proceeds the same in the presence of different ions and at different hydrogen ion concentrations is equally unknown. The hydrogen ion concentration (to which the floc is especially sensitive) was determined in these experiments but not controlled. Carbon dioxide could not be excluded and it is probably not without effect, especially at the higher pH values. Consequently it is beyond the range of the possible to expect that quantitative data on a system but partially controlled will do more than indicate with some definiteness the nature of the phenomena occurring. Since this paper is a preliminary report upon this phase of the problem, one is perhaps justified in hoping that future work will eliminate many of the crudities, which must of necessity appear in the early stages of any investigation.

In this paper the term *solid solution* has been applied to the phenomenon observed in the reciprocal displacement of sulphate and oxalate from the aluminum hydroxide floc. The work of Haber (1922) and of Hedval (1922) on the X-ray study of the aluminum precipitate suggests that it consisted of very small crystals. Whether the phenomenon described here is a true solid solution formation in which the sulphate or oxalate radical actually forms an integral part of the space lattice it is not possible to say. Data at hand are not conclusive; therefore no attempt will be made to discuss the question. Until final proof is available, the term *solid solution* will be used to describe the phenomena manifested by alum floc, because of the similarity of these phenomena to those exhibited by systems in which there is good reason to believe *solid solution* exists.

In the application of the phase rule to alum floc it becomes evident that all negative ions present in solution are of importance, especially if they be of the polyvalent type. In this connection it was observed that as oxalate replaced sulphate in the floc a progressive change in some of the properties of the floc occurred. In water purification by alum it may be that the composition of the raw water, especially with respect to the negative ions it contains, and the character of the negative ions in the reagents added (alum, lime, soda ash, etc.) will have a profound influence on the character and efficiency of the floc formed. As is well known, the character of the raw water determines the treatment which it receives at filter plants and the conditions for most efficient purification. Highly colored waters from swampy areas are believed to contain coloring matter of an acidic nature.

(See Norcom, 1924.) Hale (1914) advanced the idea that the purification of such waters consisted in a chemical combination between alum and the acidic colored compound. The principles laid down in this paper may therefore serve as a point of departure for a further study of these waters. The work of Smith (1919) suggests that in certain cases the character of the positive metallic ions present may have an influence on the efficiency of water clarification by alum. The influence of the hydrogen or hydroxyl ion concentration in relation to floc formation has been emphasized (see Theriault and Clark, 1922) and is becoming more and more fully appreciated by the workers in the field of water purification. We wish to emphasize the importance of the ionic content of the solution (other than hydrogen ion or hydroxyl ion) in which the floc is formed, and the ionic environment of the floc after formation in its relation to the composition of the floc and the effect which it may have upon efficiency in water clarification.

I am indebted to Dr. R. W. G. Wyckoff, of the United States Geophysical Laboratory, and to Dr. L. P. Hammett, of Columbia University, for some excellent suggestions. I wish also to express my thanks to Dr. William Mansfield Clark, chief of the division of chemistry, Hygienic Laboratory, for numerous suggestions during the course of this work and for valuable assistance and criticism in the preparation of this manuscript.

SUMMARY.

1. It has been emphasized that the Freundlich adsorption isotherm indicates nothing as to the mechanism of adsorption. The generality of the equation has been pointed out, and its relation to adsorptions, the mechanism of which is known, has been discussed.

2. A study has been made of the reciprocal displacement of negative ions in the alum floc and a comparison made with similar phenomena in other systems.

3. The results indicate that the displacement follows the law of distribution between solutions. Alum floc, therefore, behaves as a single solid phase—a solid solution.

4. The application of these principles to water purification by alum floc has been pointed out.

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VIRGINIA LAW REQUIRING SANITARY PRIVIES OR CLOSETS.

The Virginia Legislature, at its 1924 session, passed a law (chapter 465, approved March 21, 1924), making unlawful the occupancy or the renting or leasing for occupancy of a building used as a human habitation until the said building had been supplied with a sanitary

privy or closet. The act, which in the above provision is applicable only to cities and incorporated towns and the territory within a radius of one-half mile beyond the corporate limits thereof, reads as follows:

1. *Be it enacted by the General Assembly of Virginia,* That in any city or incorporated town in the State and for a radius of one-half mile beyond the corporate limits thereof it shall be unlawful for the owner of any house or other building to be used as a human habitation to occupy or to rent or lease the same for occupancy by any person, firm, or corporation, or for any person, firm, or corporation to occupy same until said house shall have been supplied with a sanitary privy or closet of such form as to comply with the law. If any landlord shall fail to supply any house of his with a sanitary privy or closet as required by this act, his tenant shall supply the same in conformity with the orders of a health officer or health inspector and may deduct the cost thereof from any sum due the landlord for rent.

2. That it shall be unlawful to maintain or to rent or lease any recreation or construction camp or camping place for tourists, to use any building for educational purposes, or to permit the use of any building or tent for protracted meetings until such camps or buildings are supplied with sanitary closets or privies.

3. That for the purpose of this act a "sanitary closet or privy" is deemed to be any one which provides for the disposal of human wastes or excrements in such a manner that they shall not be accessible to flies or obviously endanger a source of drinking water.

4. That it shall be unlawful for any tenant or lessor of a premises properly supplied with such a sanitary privy or closet to neglect it or to allow it to cease to be sanitary within the meaning of this act.

5. Any person, firm, or corporation violating any provision of this act shall be deemed guilty of a misdemeanor and, upon conviction thereof, shall be fined not less than $5 nor more than $25, and each week's failure to comply with any provision of this act shall be deemed a separate offense.

DEATH RATES IN A GROUP OF INSURED PERSONS.

COMPARISON OF PRINCIPAL CAUSES OF DEATH, APRIL AND MARCH, 1924, AND APRIL AND YEAR, 1923.

The accompanying table is taken from the Statistical Bulletin for May, 1924, published by the Metropolitan Life Insurance Co., and presents the mortality experience of the industrial insurance department of the company for April, 1924, as compared with that for March, 1924, and April and year, 1923. The rates are based on a strength of approximately 15,000,000 insured persons.

Contrary to the usual seasonal tendency, a rise occurred in the death rate for this group of persons for April as compared with the rate for March, increases being recorded in the rates for organic heart diseases and tuberculosis, both of which are numerically important causes of death, and for measles, scarlet fever, whooping cough, diarrheal and puerperal diseases, which, although less important from a numerical standpoint, are of major public health interest.

In most of these diseases the death rates were also higher in April of this year than in the same month a year ago.

As compared with the rates for March, declines in April were recorded for diphtheria, cerebral hemorrhage, pneumonia, and Bright's disease. The leading cause of death in this group in April was pneumonia, the rate for which, although registering a decline as compared with that for March, was 26 per cent higher than for April last year.

Death rates (annual basis) for principal causes per 100,000 lives exposed, March and April, 1924, and April and year, 1923.

Cause of death.	Death rate per 100,000 lives exposed.[1]			
	April, 1924.	March, 1924.	April, 1923.	Year 1923.[2]
Total, all causes	1,047.2	1,018.9	1,040.3	923.9
Typhoid fever	2.7	2.1	3.9	5.1
Measles	14.4	13.9	13.5	9.4
Scarlet fever	6.5	4.8	6.6	4.4
Whooping cough	11.3	9.0	7.8	7.4
Diphtheria	12.3	15.3	12.5	15.5
Influenza	28.3	29.7	49.7	30.2
Tuberculosis (all forms)	117.2	112.1	121.3	109.6
Tuberculosis of respiratory system	103.3	101.2	110.7	99.2
Cancer	71.1	68.4	75.8	71.5
Diabetes mellitus	16.4	16.5	21.6	15.9
Cerebral hemorrhage	58.8	67.6	67.1	61.0
Organic diseases of heart	143.5	135.8	141.5	126.7
Pneumonia (all forms)	144.4	150.3	114.5	83.5
Other respiratory diseases	18.6	16.4	16.5	13.9
Diarrhea and enteritis	20.3	17.9	12.4	28.1
Bright's diseases (chronic nephritis)	73.7	75.1	79.5	68.5
Puerperal state	19.3	17.0	18.3	17.6
Suicides	7.9	6.2	7.1	7.3
Homicides	7.3	6.3	6.7	7.2
Other external causes (excluding suicides and homicides)	51.3	50.2	56.2	62.7
Traumatism by automobile	12.6	8.7	11.2	15.2
All other causes	221.7	204.4	207.8	178.6

[1] All figures include infants insured under one year of age.
[2] Based on provisional estimate of lives exposed to risk in 1923.

DEATHS DURING WEEK ENDED JUNE 7, 1924.

Summary of information received by telegraph from industrial insurance companies for week ended June 7, 1924, and corresponding week of 1923. (From the Weekly Health Index, June 10, 1924, issued by the Bureau of the Census, Department of Commerce.)

	Week ended June 7, 1924.	Corresponding week, 1923.
Policies in force	56, 256, 504	52, 371, 677
Number of death claims	11, 000	9, 748
Death claims per 1,000 policies in force, annual rate	10. 2	9. 7

Deaths from all causes in certain large cities of the United States during the week ended June 7, 1924, infant mortality, annual death rate, and comparison with corresponding week of 1923. (From the Weekly Health Index, June 10, 1924, issued by the Bureau of the Census, Department of Commerce.)

City.	Week ended June 7, 1924.		Annual death rate per 1,000, corresponding week, 1923.	Deaths under 1 year.		Infant mortality rate, week ended June 7, 1924.[2]
	Total deaths.	Death rate.[1]		Week ended June 7, 1924.	Corresponding week, 1923.	
Total (64 cities)	6,353	12.3	[3] 13.0	736	[3] 888	
Albany [4]	42	18.5	18.2	5	7	110
Atlanta	63	14.4	17.8	8	6	
Baltimore [4]	203	13.5	15.8	28	34	81
Birmingham	48	12.5	15.7	6	14	
Boston	203	13.6	15.8	21	32	58
Bridgeport	40			3	4	47
Buffalo	135	12.9	16.3	19	33	81
Cambridge	23	10.7	11.7	0	2	0
Camden	39	16.1	16.0	4	7	63
Chicago [4]	608	10.8	11.9	73	114	67
Cincinnati	114	14.6	15.5	13	12	82
Cleveland	172	9.8	11.8	20	35	52
Columbus	60	11.7	13.2	4	2	38
Dallas	40	11.1	10.0	9	8	
Dayton	33	10.2	8.2	4	3	67
Denver	69			11	9	
Des Moines	31	11.1	10.0	2	2	
Detroit	249			43	51	80
Duluth	25	12.0	7.4	5	1	107
Fall River [4]	38	16.4	10.8	9	6	127
Flint	21			2	5	35
Fort Worth	24	8.4	6.2	1	1	
Grand Rapids	30	10.5	11.4	1	2	16
Houston	45			6	3	
Indianapolis	82	12.2	13.2	6	10	45
Jacksonville, Fla	36	18.3	23.5	6	5	
Jersey City	75	12.5	11.8	13	6	94
Kansas City, Kans	35	15.5	17.6	3	6	60
Kansas City, Mo	79	11.5	13.3	9	12	
Los Angeles	255			34	33	106
Louisville	73	14.7	16.6	6	11	58
Lowell	27	12.2	13.1	3	8	54
Lynn	31	15.6	9.1	4	4	101
Memphis	56	16.9	20.8	4	6	
Milwaukee	110	11.7	9.3	19	19	87
Minneapolis	102	12.7	11.9	11	13	59
Nashville [4]	39	16.5	19.1	2	3	
New Bedford	23	9.0	9.6	2	6	31
New Haven	27	8.0	11.5	3	6	39
New Orleans	122	15.5	16.1	12	17	
New York	1,432	12.4	12.4	185	183	75
Bronx Borough	155	9.3	11.0	14	24	49
Brooklyn Borough	476	11.3	11.0	64	51	69
Manhattan Borough	638	14.7	14.5	82	95	80

[1] Annual rate per 1,000 population.
[2] Deaths under 1 year per 1,000 births—an annual rate based on deaths under 1 year for the week and estimated births for 1923. Cities left blank are not in the registration area for births.
[3] Data for 62 cities.
[4] Deaths for week ended Friday, June 6, 1924.

Deaths from all causes in certain large cities of the United States during the week ended June 7, 1924, infant mortality, annual death rate, and comparison with corresponding week of 1923—Continued.

City.	Week ended June 7, 1924.		Annual death rate per 1,000, corresponding week, 1923.	Deaths under 1 year.		Infant mortality rate, week ended June 7, 1924.
	Total deaths.	Death rate.		Week ended June 7, 1924.	Corresponding week, 1923.	
New York—Continued.						
Queens Borough	109	10.2	9.9	19	10	104
Richmond Borough	54	21.5	19.2	6	3	109
Newark, N. J.	102	11.9	13.4	10	12	47
Norfolk	37	11.8	12.5	5	7	91
Oakland	53	11.2	9.1	6	6	75
Oklahoma City	18	9.0		1		
Omaha	41	10.3	8.2	4	7	43
Paterson	33	12.2	12.0	4	4	65
Philadelphia	462	12.3	13.1	54	65	69
Pittsburgh	176	14.7	15.7	22	26	75
Portland, Oreg.	71	13.3	9.9	4	4	41
Providence	68	14.5	14.6	8	11	65
Richmond	59	16.7	15.8	7	13	82
Rochester	55	8.8		8		63
St. Louis	214	13.7	13.7	15	13	
St. Paul	45	9.6	12.3	6	3	52
Salt Lake City [1]	26	10.5	9.1	5	0	83
San Antonio	74	20.2	23.7	16	15	
San Francisco	124	11.8	12.5	6	12	36
Schenectady	19	9.9	13.7	1	5	28
Seattle	58			1	3	10
Somerville	24	12.5	9.0	1	5	27
Spokane	25			1	5	21
Springfield, Mass.	31	10.9	8.3	6	5	101
Tacoma	19	9.6	11.8	3	2	69
Toledo	67	12.6	14.7	5	12	47
Trenton	31	12.5	15.6	2	3	33
Utica	24	11.9	8.6	2	0	43
Washington, D. C.	89	9.5	12.4	6	8	35
Waterbury	23			6	7	134
Wilmington, Del.	23	10.0	13.7	4	6	87
Worcester	42	11.2	12.2	1	5	12
Yonkers	19	9.0	5.8	1	0	22
Youngstown	27	9.1	5.9	3	3	43

[1] Deaths for week ended Friday, June 6, 1924.

PREVALENCE OF DISEASE.

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring.

UNITED STATES.

CURRENT WEEKLY STATE REPORTS.

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

Reports for Week Ended June 14, 1924.

ALABAMA.

	Cases.
Cerebrospinal meningitis	1
Chicken pox	18
Diphtheria	2
Dysentery	82
Influenza	9
Malaria	88
Measles	166
Mumps	25
Pellagra	8
Pneumonia	35
Poliomyelitis	1
Scarlet fever	6
Smallpox	46
Tuberculosis	43
Typhoid fever	22
Whooping cough	44

ARIZONA.

Chicken pox	2
Diphtheria	3
Dysentery	2
Measles	29
Mumps	4
Pneumonia	2
Scarlet fever	16
Tuberculosis	44
Typhoid fever	2
Whooping cough	3

ARKANSAS.

Chicken pox	18
Diphtheria	3
Hookworm disease	4
Influenza	26
Malaria	120
Measles	77
Mumps	32
Ophthalmia neonatorum	1
Pellagra	13

ARKANSAS—continued.

	Cases.
Scarlet fever	3
Smallpox	6
Tuberculosis	11
Typhoid fever	12
Whooping cough	44

CALIFORNIA.

Diphtheria	156
Influenza	5
Lethargic encephalitis—San Francisco	1
Measles	347
Scarlet fever	65
Smallpox:	
Lassen County	12
Long Beach	9
Scattering	40
Typhoid fever	14

COLORADO.

(Exclusive of Denver.)

Chicken pox	11
Diphtheria	26
Influenza	3
Measles	57
Mumps	2
Pneumonia	5
Scarlet fever	18
Smallpox	1
Tuberculosis	41
Typhoid fever	2
Whooping cough	1

CONNECTICUT.

Chicken pox	59
Diphtheria	18
German measles	29
Influenza	1
Lethargic encephalitis	3
Measles	132

CONNECTICUT—continued.	Cases.
Mumps	113
Pneumonia (lobar)	19
Scarlet fever	106
Smallpox	1
Tuberculosis (all forms)	41
Typhoid fever	1
Whooping cough	20
DELAWARE.	
Chicken pox	2
Diphtheria	1
Measles	12
Mumps	5
Pneumonia	1
Scarlet fever—Wilmington	6
Tetanus	1
Whooping cough	6
FLORIDA.	
Diphtheria	2
Malaria	14
Pneumonia	1
Poliomyelitis	1
Smallpox	1
Typhoid fever	6
GEORGIA.	
Chicken pox	12
Diphtheria	6
Dysentery (bacillary)	11
Hookworm disease	4
Malaria	16
Measles	11
Mumps	9
Pellagra	2
Pneumonia	13
Scarlet fever	8
Septic sore throat	1
Smallpox	28
Tuberculosis (pulmonary)	8
Typhoid fever	10
Whooping cough	16
ILLINOIS.	
Cerebrospinal meningitis—Chicago	2
Diphtheria:	
Cook County	71
Scattering	35
Influenza	5
Lethargic encephalitis—Winnebago County	1
Measles	683
Pneumonia	208
Poliomyelitis—Chicago	1
Scarlet fever:	
Cook County	126
La Salle County	16
Scattering	65
Smallpox:	
Cook County	9
Lake County	10
Madison County	34
Scattering	23
Tuberculosis	333
Typhoid fever	18
Whooping cough	125
INDIANA.	
Chicken pox	71
Diphtheria	39

INDIANA—continued.	Cases.
Measles	279
Pneumonia	5
Scarlet fever:	
Allen County	11
Lake County	12
St. Joseph County	9
Scattering	24
Smallpox:	
Marion County	45
Miami County	10
Scattering	72
Tuberculosis:	
Marion County	11
Scattering	46
Typhoid fever	2
Whooping cough	22
IOWA.	
Diphtheria	12
Scarlet fever	14
Smallpox	5
KANSAS.	
Cerebrospinal meningitis	3
Chicken pox	39
Diphtheria	12
German measles	1
Influenza	7
Measles	253
Mumps	96
Pneumonia	42
Scarlet fever	46
Smallpox	36
Tetanus	1
Tuberculosis	86
Typhoid fever	9
Whooping cough	55
LOUISIANA.	
Anthrax	1
Diphtheria	13
Malaria	37
Measles	12
Pellagra	5
Pneumonia	14
Scarlet fever	5
Smallpox	19
Tuberculosis	61
Typhoid fever	21
Whooping cough	5
MAINE.	
Chicken pox	43
Diphtheria	3
German measles	28
Measles	55
Mumps	11
Pneumonia	11
Scarlet fever	15
Tuberculosis	10
Typhoid fever	8
Whooping cough	15
MARYLAND.[1]	
Cerebrospinal meningitis	1
Chicken pox	68
Diphtheria	28
German measles	12

[1] Week ended Friday.

MARYLAND—continued.	Cases.
Influenza	6
Lethargic encephalitis	1
Malaria	1
Measles	185
Mumps	37
Ophthalmia neonatorum	1
Pellagra	1
Pneumonia (all forms)	43
Poliomyelitis	1
Scarlet fever	66
Septic sore throat	2
Smallpox	16
Tuberculosis	97
Typhoid fever	27
Whooping cough	49

MASSACHUSETTS.	
Anthrax	1
Cerebrospinal meningitis	5
Chicken pox	146
Conjunctivitis (suppurative)	5
Diphtheria	129
Dysentery	1
German measles	54
Influenza	5
Lethargic encephalitis	1
Malaria	1
Measles	608
Mumps	263
Ophthalmia neonatorum	22
Pneumonia (lobar)	106
Scarlet fever	261
Septic sore throat	2
Smallpox	1
Trachoma	2
Tuberculosis (all forms)	139
Typhoid fever	11
Whooping cough	53

MICHIGAN.	
Diphtheria	95
Measles	654
Pneumonia	96
Scarlet fever	229
Smallpox	186
Tuberculosis	80
Typhoid fever	14
Whooping cough	95

MINNESOTA.	
Chicken pox	85
Diphtheria	39
Measles	40
Pneumonia	12
Poliomyelitis	1
Scarlet fever	130
Smallpox	27
Tuberculosis	85
Typhoid fever	4
Whooping cough	24

MISSISSIPPI.	
Diphtheria	4
Poliomyelitis	1
Scarlet fever	5
Smallpox	22
Typhoid fever	18

MISSOURI.	Cases.
Anthrax	1
Chicken pox	41
Diphtheria	36
Influenza	2
Measles	118
Mumps	57
Pneumonia	9
Scarlet fever	94
Smallpox	32
Trachoma	32
Tuberculosis	36
Typhoid fever	10
Whooping cough	61

MONTANA.	
Diphtheria	2
Rocky Mountain spotted fever:	
Billings R. F. D	1
Scarlet fever	19
Smallpox	6
Typhoid fever	1

NEBRASKA.	
Chicken pox	20
Diphtheria	11
Measles	20
Mumps	2
Scarlet fever	12
Smallpox	5
Whooping cough	4

NEW JERSEY.	
Cerebrospinal meningitis	4
Chicken pox	157
Diphtheria	71
Influenza	4
Malaria	3
Measles	507
Pneumonia	106
Scarlet fever	134
Smallpox	18
Typhoid fever	9
Whooping cough	129

NEW MEXICO.	
Chicken pox	12
Diphtheria	4
German measles	1
Malaria	3
Measles	37
Mumps	4
Pneumonia	3
Scarlet fever	4
Tuberculosis	8
Typhoid fever	9
Whooping cough	3

NEW YORK.	
(Exclusive of New York City.)	
Cerebrospinal meningitis	1
Diphtheria	71
Influenza	9
Measles	1,023
Pneumonia	188
Poliomyelitis	3
Scarlet fever	201

NEW YORK—continued.	Cases.
Smallpox	10
Typhoid fever	10
Whooping cough	219
NORTH CAROLINA.	
Cerebrospinal meningitis	1
Chicken pox	58
Diphtheria	12
German measles	2
Measles	255
Scarlet fever	24
Smallpox	40
Typhoid fever	24
Whooping cough	239
NORTH DAKOTA.	
Diphtheria	5
Measles	4
Pneumonia	2
Scarlet fever	13
Smallpox	3
OREGON.	
Botulism	1
Chicken pox	15
Diphtheria	10
Influenza	1
Measles	17
Mumps	9
Pneumonia	[1] 4
Scarlet fever	18
Smallpox	10
Tuberculosis	11
Typhoid fever	7
Whooping cough	2
SOUTH DAKOTA.	
Chicken pox	1
Diphtheria	2
Measles	39
Pneumonia	5
Scarlet fever	21
Typhoid fever	1
Whooping cough	1
TEXAS.	
Chicken pox	38
Dengue	8
Diphtheria	21
Influenza	10
Measles	116
Mumps	19
Pellagra	4
Pneumonia	11
Scarlet fever	18
Smallpox	18
Tuberculosis	20
Typhoid fever	10
Whooping cough	42
VERMONT.	
Chicken pox	22
Diphtheria	3

[1] Deaths.

VERMONT—continued.	Cases.
Measles	59
Mumps	3
Scarlet fever	6
Typhoid fever	1
Whooping cough	26
VIRGINIA.	
Smallpox—Fairfax County	1
WASHINGTON.	
Chicken pox	73
Diphtheria	44
Measles	28
Mumps	18
Scarlet fever	39
Smallpox	17
Tuberculosis	42
Typhoid fever	4
Whooping cough	17
WEST VIRGINIA.	
Diphtheria	11
Scarlet fever	20
Typhoid fever	5
WISCONSIN.	
Milwaukee:	
Chicken pox	155
Diphtheria	19
German measles	1
Measles	39
Mumps	34
Pneumonia	3
Scarlet fever	16
Smallpox	2
Tuberculosis	10
Whooping cough	22
Scattering:	
Chicken pox	146
Diphtheria	39
German measles	46
Influenza	11
Measles	232
Mumps	3
Pneumonia	27
Scarlet fever	127
Smallpox	39
Tuberculosis	25
Typhoid fever	5
Whooping cough	64
WYOMING.	
Chicken pox	5
Influenza	1
Measles	12
Mumps	11
Rocky Mountain spotted fever	4
Scarlet fever	2
Smallpox	3
Tuberculosis	1
Typhoid fever	1
Whooping cough	4

SUMMARY OF MONTHLY REPORTS FROM STATES.

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week:

State	Cerebrospinal meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
April, 1924										
California	13	1,089	115	10	6,641	3	4	1,198	1,746	159
May, 1924										
Arkansas	1	17	160	241	602	42	1	12	57	18
Florida	3	30	31	67	167	10		20	19	51
Georgia	2	56	12	48	83	2		42	221	12
Indiana	3	138	125		1,709	1		383	615	42
Massachusetts	8	559	42	3	3,355	2	5	1,447	3	44
Vermont		10			327			55	2	

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES.

During the month of May, there was a decided decrease in the number of cases of communicable diseases reported.

Diphtheria.—For the week ended May 31, 1924, 34 States reported 1,394 cases of diphtheria. For the week ended June 2, 1923, the same States reported 1,429 cases. One hundred cities, situated in all parts of the country and having an aggregate population of about 28,400,000, reported 855 cases of diphtheria for the week ended May 31, 1924. Last year for the corresponding week they reported 856 cases. The estimated expectancy for these cities for the week was 929 cases. The estimated expectancy was based on the experience of the last nine years, excluding epidemics.

Measles.—Twenty-nine States reported 7,792 cases of measles for the week this year and 20,235 cases for the week last year. One hundred cities reported 2,917 cases of measles for the week this year and 7,952 cases last year.

Scarlet fever.—Scarlet fever was reported for the week as follows: Thirty-four States—this year, 2,397 cases; last year, 2,578 cases. One hundred cities—this year, 1,201 cases; last year, 1,274 cases; estimated expectancy, 783 cases.

Smallpox.—Although the number of cases of smallpox was less than for any week since early in January, yet the figures for this disease continue to show much suffering and many deaths which could have been avoided by vaccination and revaccination.

Thirty-four States reported 858 cases of smallpox for the week ended May 31, 1924. For the corresponding week of last year they reported 499 cases. One hundred cities reported smallpox for the week as follows: 1924, 332 cases; 1923, 122 cases; estimated expec-

tancy, 179 cases. The city of Detroit, Mich., reported 23 deaths from smallpox during the week.

Typhoid fever.—Two hundred and forty-three cases of typhoid fever were reported by 33 States for the week this year. Last year the number was 252 cases. One hundred cities reported 75 cases for the week in 1924 and 45 cases for the corresponding week in 1923. The estimated expectancy was 82 cases.

Influenza and pneumonia.—Deaths from influenza and pneumonia (combined) were reported for the week by 100 cities as follows: 1924, 620 deaths; 1923, 592 deaths.

City reports for week ended May 31, 1924.

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence how many cases of the disease under consideration may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding week of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If reports have not been received for the full nine years, data are used for an many years as possible, but no year earlier than 1915 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviations from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city.	Chicken pox, cases reported.	Diphtheria.		Influenza.		Measles, cases reported.	Mumps, cases reported.	Pneumonia, deaths reported.	Scarlet fever.	
		Cases, estimated expectancy.	Cases reported.	Cases reported.	Deaths reported.				Cases, estimated expectancy.	Cases reported.
NEW ENGLAND.										
Maine:										
Lewiston	2	0	0	0	0	13	0	1	5	0
Portland	4	1	5	0	0	4	39	0	2	4
New Hampshire:										
Concord	0	0	0	0	0	29	0	2	0	0
Vermont:										
Barre	0	0	0	0	0	0	0	0	1	1
Burlington	2	1	1	0	0	1	0	0	0	0
Massachusetts:										
Boston	28	51	47	2	1	117	10	17	39	73
Fall River	0	3	6	1	0	4	3	3	2	3
Springfield	3	2	3	0	0	16	8	0	5	16
Worcester	6	4	5	0	0	21	9	0	5	7
Rhode Island:										
Pawtucket	0	1	3	0	0	0	3	0	1	6
Providence	0	9	4	0	0	2	0	7	8	25
Connecticut:										
Bridgeport	0	5	6	0	0	2	1	1	4	13
Hartford	2	5	6	0	0	22	9	0	3	12
New Haven	4	4	0	0	0	10	13	4	2	8
MIDDLE ATLANTIC.										
New York:										
Buffalo	0	12	7	0	0	19	0	6	19	7
New York	173	298	249	7	4	840	149	164	154	206
Rochester	0	9	1	0	0	48	32	3	10	20
Syracuse	4	7	13	0	0	46	8	5	7	25
New Jersey:										
Camden	----	3	5	0	0	2	----	2	3	2
Newark	----	15	9	2	0	109	----	9	13	22
Trenton	5	5	8	0	0	8	1	2	2	2
Pennsylvania:										
Philadelphia	82	60	56	1	3	125	98	39	60	59
Pittsburgh	52	20	16	----	3	25	122	34	15	35
Reading	4	1	7	0	0	9	55	3	2	2
Scranton	2	3	0	0	0	4	2	3	2	2

City reports for week ended May 31, 1924—Continued.

Division, State, and city.	Chicken pox, cases reported.	Diphtheria.		Influenza.		Measles, cases reported.	Mumps cases reported.	Pneumonia, deaths reported.	Scarlet fever.	
		Cases, estimated expectancy.	Cases reported.	Cases reported.	Deaths reported.				Cases, estimated expectancy.	Cases reported.
E. NORTH CENTRAL.										
Ohio:										
Cincinnati	10	10	6	0	0	45	16	7	9	7
Cleveland	70	19	19	1	3	146	159	14	21	8
Columbus		2							5	
Toledo	11	4	1	0	0	90	0	5	10	16
Indiana:										
Fort Wayne		4	0	0	0	62		2	2	1
Indianapolis		6	1	0	0	61	65	13	15	3
South Bend	5	1	2	0	0	7	0	3	2	10
Terre Haute	3	1	0	0	0	1	0	2	3	0
Illinois:										
Chicago	121	111	38	6	5	210	80	46	80	86
Cicero	1	2	1	0	0	14	11	2	1	0
Peoria	16	2	1	0	0	6	1	3	3	3
Springfield		1	0	0	0	8		6	2	1
Michigan:										
Detroit	100	56	36		2	142	52	28	56	85
Flint	4	4	3	0	0	1	28	2	5	7
Grand Rapids	8	3	3	0	0	7	25	2	4	7
Saginaw	5	1	2	0	0	10	0	2	2	10
Wisconsin:										
Madison	9	0	2	0	0	2	4	1	2	1
Milwaukee	104	11	12	0	0	22	28	0	24	14
Racine	10	1	2	0	0	0	0	0	4	7
Superior	2	0	1	0	0	1	0	0	2	2
W. NORTH CENTRAL.										
Minnesota:										
Duluth	10	1	0	0	0	7	0	4	4	17
Minneapolis	51	13	13	0	0	15	8	7	24	40
St. Paul		13	19	0	0	4		6	15	21
Iowa:										
Davenport	0	1	9	0		0	0		2	0
Des Moines	0	2	4	0		0	0		6	5
Sioux City	0	1	0	0		0	0		3	0
Waterloo	4	0	0	0		3	4		4	2
Missouri:										
Kansas City	9	6	2	1	1	27	17	6	7	7
St. Joseph	1	1	0	0	0	0	4	4	1	0
St. Louis	30	40	43	0	0	46	47		21	71
North Dakota:										
Fargo	0	0	0	0	0	0	0	1	0	0
Grand Forks	0	0	0	0	0	0	0	0	0	2
South Dakota:										
Aberdeen	1		0	0		9	0			0
Sioux Falls	6	0	0	0	0	0	0	0	1	2
Nebraska:										
Lincoln		0	3	0	0	1		0	1	0
Omaha	8	2	1	0	0	10	0	10	6	0
Kansas:										
Topeka	13	1	1	0	0	9	0	2	1	4
Wichita	15	1	1	0	0	3	4	0	2	1
SOUTH ATLANTIC.										
Delaware:										
Wilmington		1							3	
Maryland:										
Baltimore	51	15	25	4	1	170	24	26	19	45
Cumberland		0	0	0	0	1		0	1	1
Frederick	0	0	0	0	0	0	0	0	0	9
District of Columbia:										
Washington	22	9	4	2	2	22		9	12	25
Virginia:										
Lynchburg	1	0	0	0	0	0	3	1	1	1
Norfolk	9	0	0	0	0	8	2	3	1	0
Richmond	8	1	1	0	0	85	0	0	2	3
Roanoke	3	1	0	0	0	0	0	0	0	1
West Virginia:										
Charleston	0	0	0	0	0	20	1	1	1	2
Huntington	0	0	0	0	0	0	0	0	1	0
Wheeling	1	1	0	0	0	8	4	3	1	2
North Carolina:										
Raleigh	14	0	0	0	0	12	0	0	0	0
Wilmington	4	0	0	0	0	8	3	1	0	0
Winston-Salem		0	0	0	0	0		3	0	12

City reports for week ended May 31, 1924—Continued.

Division, State, and city.	Chicken pox, cases reported.	Diphtheria.		Influenza.		Measles, cases reported.	Mumps, cases reported.	Pneumonia, deaths reported.	Scarlet fever.	
		Cases, estimated expectancy.	Cases reported.	Cases reported.	Deaths reported.				Cases, estimated expectancy.	Cases reported.
SOUTH ATLANTIC—continued.										
South Carolina:										
Charleston	0	0	0		1	0	0	2	0	1
Columbia	4	1	1	0	0	4	3	1	0	0
Greenville	0	0	0	0	0	0	0	1	0	0
Georgia:										
Atlanta	0	1	0	1	1	0	0	9	4	7
Brunswick	4	0	0	0	0	0	0	0	0	0
Savannah	0	0	0	0	0	0	0	0	1	0
Florida:										
St. Petersburg										
Tampa		1	0	0	0	1		0	0	0
EAST SOUTH CENTRAL										
Kentucky:										
Covington	0	1	0	0	0	6	0	4	1	1
Lexington	0	0	0	0	0	3	0	1	1	3
Louisville	2	3	1		1	6	4	6	2	1
Tennessee:										
Memphis	4	2	2	0	0	6	9	10	4	4
Nashville	2	0	0	0	0	10	0	6	2	0
Alabama:										
Birmingham	6	0	0	0	0	11	22	12	1	2
Mobile	0	0	1	0	0	8	0	0	1	0
Montgomery		0	0	0	0	0		2	0	0
WEST SOUTH CENTRAL.										
Arkansas:										
Fort Smith	3	1	0	0		4	0		1	1
Little Rock	3	0	1	0	0	3	1	3	0	0
Louisiana:										
New Orleans	3	5	10	0	0	14	0	5	1	6
Shreveport	0		2	0	0	0	0	1		0
Oklahoma:										
Oklahoma	0	0	0	0	0	0	0	2	2	2
Texas:										
Dallas	8	2	3		1	7	12	1	1	1
Galveston	0	1	0	0	0	0	0	0	0	0
Houston		1	2	0	0	0		0	1	1
San Antonio	0	2	0	0	0	0	0	4	1	2
MOUNTAIN.										
Montana:										
Billings	7	0	0	0	0	1	0	0	1	1
Great Falls	0	1	2	0	0	0	0	1	1	2
Helena	0		0	0	0	0	0	0		0
Missoula	0	1	0	0	0	0	0	1	1	0
Idaho:										
Boise	0	0	0	0	0	3	0	0	1	0
Colorado:										
Denver	22	9	7	0	0	50	0	9	8	9
Pueblo	6	1	3	0	0	1	0	1	1	1
New Mexico:										
Albuquerque	0	1	1	0	0	12	0	2	1	1
Utah:										
Salt Lake City	24	3	2	0	0	15	3	4	3	4
Nevada:										
Reno	0	1	0	0	0	0	0	2	0	0
PACIFIC.										
Washington:										
Seattle	34	4	8	0		4	9		5	14
Spokane	49	2	0	0		8	0		2	6
Tacoma		1							2	
Oregon:										
Portland	6	3	4	0	0	1	0	4	9	4
California:										
Los Angeles	47	23	68	2	1	102	8	21	10	50
Sacramento	7	1	8	0	0	8	0	0	2	1
San Francisco	45	15	49	2	0	15	32	5	12	17

City reports for week ended May 31, 1924—Continued.

Division, State, and city.	Population, July 1, 1923, estimated.	Smallpox.			Tuberculosis, deaths reported.	Typhoid fever.			Whooping cough, cases reported.	Deaths, all causes.
		Cases, estimated expectancy.	Cases reported.	Deaths reported.		Cases, estimated expectancy.	Cases reported.	Deaths reported.		
NEW ENGLAND.										
Maine:										
Lewiston	33,790	0	0	0	0	0	0	0	0	11
Portland	73,129	0	0	0	1	1	2	0	3	16
New Hampshire:										
Concord	22,408	0	0	0	0	0	0	0	0	11
Vermont:										
Barre	[1] 10,008	0	0	0	1	0	0	0	0	4
Burlington	23,613	0	0	0	0	0	0	0	1	2
Massachusetts:										
Boston	770,400	0	0	0	15	2	2	0	16	197
Fall River	120,912	0	0	0	3	1	0	0	2	36
Springfield	144,227	0	0	0	1	0	0	0	0	32
Worcester	191,927	0	0	0	4	0	3	0	0	31
Rhode Island:										
Pawtucket	68,799	0	0	0	0	0	0	0	0	18
Providence	242,378	0	0	0	4	0	1	0	0	70
Connecticut:										
Bridgeport	[1] 143,555	0	0	0	0	0	0	0	1	23
Hartford	[1] 138,036	0	0	0	1	0	0	0	1	32
New Haven	172,967	0	0	0	4	1	1	0	1	39
MIDDLE ATLANTIC.										
New York:										
Buffalo	536,718	0	0	0	13	1	0	0	14	116
New York	5,927,625	0	0	0	[2] 101	12	12	3	157	1,368
Rochester	317,867	0	0	0	1	0	0	0	2	74
Syracuse	184,511	0	0	0	3	0	2	0	1	50
New Jersey:										
Camden	124,157	0	0	0	5	1	0	0	----	37
Newark	438,699	0	0	0	9	1	0	0	----	90
Trenton	127,390	0	0	0	3	1	0	0	13	34
Pennsylvania:										
Philadelphia	1,922,788	0	1	0	41	7	3	2	52	469
Pittsburgh	613,442	0	0	0	13	2	1	0	28	166
Reading	110,917	0	0	0	1	1	0	0	15	30
Scranton	140,636	0	0	0	2	0	0	0	0	----
EAST NORTH CENTRAL.										
Ohio:										
Cincinnati	406,312	1	5	0	11	1	1	0	8	121
Cleveland	888,519	2	2	0	14	2	0	0	62	168
Columbus	261,082	2	----	----	----	0	----	----	----	----
Toledo	268,338	3	12	0	7	1	0	0	17	60
Indiana:										
Fort Wayne	93,573	3	15	0	1	0	0	0	----	21
Indianapolis	342,718	10	38	0	5	0	1	0	----	101
South Bend	76,709	0	0	0	0	0	0	0	0	11
Terre Haute	68,939	1	0	0	1	0	0	0	2	23
Illinois:										
Chicago	2,886,121	1	1	0	45	3	2	0	53	627
Cicero	55,968	0	0	0	0	0	0	0	1	10
Peoria	79,675	2	0	0	1	0	0	0	0	27
Springfield	61,833	1	2	0	2	0	0	0	----	25
Michigan:										
Detroit	995,668	8	69	23	18	4	1	0	36	259
Flint	117,968	1	4	0	0	0	0	1	2	24
Grand Rapids	145,947	1	0	0	1	0	0	0	3	31
Saginaw	69,754	0	0	0	3	1	0	1	2	19
Wisconsin:										
Madison	42,519	1	0	0	0	0	0	0	8	8
Milwaukee	484,595	5	0	0	9	1	1	1	16	92
Racine	64,393	0	3	0	1	0	0	0	1	12
Superior	[1] 39,671	1	5	0	0	0	0	0	0	3
WEST NORTH CENTRAL.										
Minnesota:										
Duluth	106,289	3	2	0	0	0	2	0	6	16
Minneapolis	409,125	25	1	0	3	1	1	0	1	82
St. Paul	241,891	6	10	0	6	0	1	0	----	56

[1] Population Jan. 1, 1920.

[2] Pulmonary only.

City reports for week ended May 31, 1924—Continued.

Division, State, and city.	Population, July 1, 1923, estimated.	Smallpox.			Tuberculosis, deaths reported.	Typhoid fever.			Whooping cough, cases reported.	Deaths, all causes.
		Cases, estimated expectancy.	Cases reported.	Deaths reported.		Cases, estimated expectancy.	Cases reported.	Deaths reported.		
WEST NORTH CENTRAL—continued.										
Iowa:										
Davenport	61,262	7	22	----	----	0	0	----	0	----
Des Moines	140,923	6	4	----	----	0	0	----	0	----
Sioux City	79,662	2	1	----	----	0	0	----	0	----
Waterloo	39,667	0	0	----	----	1	0	----	0	----
Missouri:										
Kansas City	351,819	6	0	0	5	1	0	0	12	69
St. Joseph	78,232	7	0	0	0	0	0	0	2	33
St. Louis	803,853	5	0	0	9	3	1	1	21	182
North Dakota:										
Fargo	24,841	0	0	0	0	0	0	0	0	6
Grand Forks	14,547	0	0	0	0	0	0	0	0	----
South Dakota:										
Aberdeen	15,829	----	0	----	----	----	0	----	----	----
Sioux Falls	29,206	1	0	0	0	0	0	0	0	1
Nebraska:										
Lincoln	58,761	3	0	0	0	0	0	0	----	8
Omaha	204,382	9	1	0	0	0	0	0	1	41
Kansas:										
Topeka	52,555	1	0	0	0	0	0	0	0	18
Wichita	79,261	7	4	0	2	0	0	0	5	20
SOUTH ATLANTIC.										
Delaware:										
Wilmington	117,728	0	----	----	----	1	----	----	----	----
Maryland:										
Baltimore	773,580	1	0	0	17	3	0	0	24	197
Cumberland	32,361	0	0	0	0	0	0	0	----	9
Frederick	11,301	0	0	0	0	0	0	0	0	6
District of Columbia:										
Washington	[1] 437,571	2	4	0	10	2	2	0	12	117
Virginia:										
Lynchburg	30,277	0	0	0	0	0	0	0	2	9
Norfolk	159,089	0	0	0	2	0	1	0	1	----
Richmond	181,044	0	1	0	2	1	0	0	8	44
Roanoke	55,502	2	0	0	0	0	0	0	3	12
West Virginia:										
Charleston	45,597	0	1	0	0	1	0	0	0	12
Huntington	57,918	0	0	0	0	0	0	0	0	13
Wheeling	[1] 56,208	0	0	0	0	0	0	0	2	13
North Carolina:										
Raleigh	29,171	0	2	1	0	0	0	1	0	18
Wilmington	35,719	0	0	0	0	1	1	0	0	6
Winston-Salem	56,239	2	4	0	4	1	0	0	----	22
South Carolina:										
Charleston	71,245	0	0	0	2	1	2	2	0	31
Columbia	39,688	0	0	0	3	1	6	1	4	14
Greenville	25,789	1	3	0	0	1	0	0	4	7
Georgia:										
Atlanta	222,903	8	15	0	7	1	0	0	0	78
Brunswick	15,937	0	0	0	1	0	0	0	0	5
Savannah	89,448	1	2	0	1	1	1	0	0	25
Florida:										
St. Petersburg	24,403	----	----	----	----	----	----	----	----	----
Tampa	56,050	0	0	0	1	2	0	0	----	14
EAST SOUTH CENTRAL.										
Kentucky:										
Covington	57,877	0	0	0	3	0	0	0	0	17
Lexington	43,673	0	0	0	0	0	0	0	0	12
Louisville	257,671	1	0	0	7	1	1	0	3	76
Tennessee:										
Memphis	170,067	2	0	0	3	1	4	0	3	62
Nashville	121,128	0	10	0	7	2	0	0	2	50
Alabama:										
Birmingham	195,901	1	24	0	5	3	6	0	5	60
Mobile	63,858	0	2	0	1	1	0	1	0	----
Montgomery	45,383	0	0	0	2	0	0	0	----	14

[1] Population Jan. 1, 1920.

City reports for week ended May 31, 1924—Continued.

Division, State, and city.	Population, July 1, 1923, estimated.	Smallpox.			Tuberculosis, deaths reported.	Typhoid fever.			Whooping cough, cases reported.	Deaths, all causes.
		Cases, estimated expectancy.	Cases reported.	Deaths reported.		Cases, estimated expectancy.	Cases reported.	Deaths reported.		
WEST SOUTH CENTRAL.										
Arkansas:										
Fort Smith	30,635	0	0	----	----	0	0	----	3	----
Little Rock	70,916	0	3	0	4	0	3	0	0	----
Louisiana:										
New Orleans	404,575	4	0	0	16	3	6	2	2	149
Shreveport	54,590	----	2	0	3	----	0	0	0	18
Oklahoma:										
Oklahoma	101,150	5	3	0	1	0	0	0	0	19
Texas:										
Dallas	177,274	2	1	0	5	1	0	0	1	48
Galveston	46,877	1	0	0	2	1	0	0	0	11
Houston	154,970	1	1	0	0	0	0	0	----	41
San Antonio	184,727	0	0	0	3	0	1	0	0	54
MOUNTAIN.										
Montana:										
Billings	16,927	1	0	0	0	1	0	0	1	5
Great Falls	27,787	4	0	0	0	0	0	0	3	6
Helena	[1] 12,037	----	0	0	1	----	1	0	0	9
Missoula	[1] 12,668	0	6	0	1	0	0	0	0	3
Idaho:										
Boise	22,806	1	1	0	0	0	0	0	0	3
Colorado:										
Denver	272,031	10	0	0	8	0	0	0	37	63
Pueblo	43,519	1	0	0	2	0	0	0	0	8
New Mexico:										
Albuquerque	16,648	0	0	0	6	0	0	0	0	15
Utah:										
Salt Lake City	126,241	5	0	0	2	1	0	0	0	29
Nevada:										
Reno	12,429	0	0	0	0	0	0	0	0	4
PACIFIC.										
Washington:										
Seattle	[1] 315,685	6	1	----	----	0	1	----	1	----
Spokane	104,373	6	7	----	----	0	0	----	7	----
Tacoma	101,731	2	----	----	----	0	----	----	----	----
Oregon:										
Portland	273,621	5	11	0	3	1	0	1	0	62
California:										
Los Angeles	666,853	3	72	0	23	2	2	1	8	230
Sacramento	69,950	1	0	0	2	1	0	0	1	21
San Francisco	539,038	0	1	0	12	1	1	1	1	142

Division, State, and city	Cerebrospinal meningitis.		Lethargic encephalitis.		Pellagra.		Poliomyelitis (infantile paralysis)		
	Cases.	Deatsh.	Cases.	Deaths.	Cases.	Deaths.	Cases, est. expectancy.	Cases.	Deaths.
NEW ENGLAND									
Massachusetts:									
Boston	1	1	1	0	0	0	0	0	0
Fall River	1	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC									
New York:									
New York	0	2	8	2	1	1	2	2	1
New Jersey:									
Newark	1	1	0	0	0	0	0	1	0

[1] Population Jan. 1, 1920.

City reports for week ended May 31, 1924—Continued.

Division, State, and city.	Cerebrospinal meningitis.		Lethargic encephalitis.		Pellagra.		Poliomyelitis (infantile paralysis).		
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases, est. expectancy.	Cases.	Deaths.
MIDDLE ATLANTIC—contd.									
Pennsylvania:									
Philadelphia	0	0	2	0	0	0	0	0	0
EAST NORTH CENTRAL									
Illinois:									
Chicago	1	2	0	1	0	0	0	0	0
Michigan:									
Detroit	2	0	0	1	0	0	0	0	0
Wisconsin:									
Milwaukee	0	1	0	0	0	0	0	0	0
WEST NORTH CENTRAL									
Missouri:									
St. Louis	1	0	0	0	0	0	0	0	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	1	3	0	2	0	0	0	0	0
North Carolina:									
Raleigh	0	0	0	0	0	3	0	0	0
Winston-Salem	0	0	0	0	0	1	0	0	0
South Carolina:									
Charleston	0	0	0	0	0	1	0	0	0
Columbia	0	0	0	0	0	1	0	0	0
Georgia:									
Atlanta	0	0	0	0	0	1	0	0	0
Savannah	0	0	0	0	0	1	0	0	0
Florida:									
Tampa	0	0	0	0	1	0	0	0	0
EAST SOUTH CENTRAL									
Tennessee:									
Memphis	0	0	0	0	1	0	0	0	0
Alabama:									
Birmingham	0	0	0	0	1	0	0	1	0
Mobile	0	0	0	0	1	0	0	0	0
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans	0	0	0	0	0	0	1	1	0
Shreveport	0	0	0	0	0	1		0	0
MOUNTAIN									
Utah:									
Salt Lake City	0	0	0	1	0	0	0	0	0
PACIFIC									
California:									
Los Angeles	0	0	1	1	0	0	0	0	0

The following table gives a summary of the reports from 105 cities for the ten-week period ended May 31, 1924. The cities included in this table are those whose reports have been published for all ten weeks in the Public Health Reports. Eight of these cities did not report deaths. The aggregate population of the cities reporting cases was estimated at nearly 29,000,000 on July 1, 1923, which is the latest date for which estimates are available. The cities reporting deaths had more than 28,000,000 population on that date. The number of cities included in each group and the aggregate population are shown in a separate table below.

Summary of weekly reports from cities, March 23 to May 31, 1924.

DIPHTHERIA CASES.

	1924, week ended—									
	Mar. 29.	Apr. 5.	Apr. 12.	Apr. 19.	Apr. 26.	May 3.	May 10.	May 17.	May 24.	May 31.
Total	1,038	1,039	1,006	1,009	988	912	892	929	941	867
New England	103	105	102	99	111	97	83	78	94	85
Middle Atlantic	391	383	384	374	400	344	395	357	340	371
East North Central	200	219	210	211	156	173	157	168	175	[1] 130
West North Central	66	74	60	60	71	68	64	110	106	80
South Atlantic	42	61	52	52	50	[2] 40	31	[2] 41	46	[3] 31
East South Central	10	17	8	14	13	6	8	3	8	4
West South Central	32	23	24	31	33	18	26	16	18	18
Mountain	31	30	40	52	31	35	29	18	30	14
Pacific	163	127	126	116	123	131	99	138	124	[4] 134

MEASLES CASES.

Total	6,590	6,070	6,237	5,147	5,203	4,729	4,420	4,017	3,752	2,942
New England	443	374	401	353	354	379	339	271	310	227
Middle Atlantic	2,354	2,394	2,647	2,347	2,184	2,310	1,889	1,868	1,571	1,231
East North Central	674	866	838	675	829	703	862	781	873	[1] 733
West North Central	766	569	415	359	350	257	274	197	128	124
South Atlantic	621	572	626	487	518	[2] 484	[2] 455	[2] 403	484	[3] 343
East South Central	173	126	156	159	173	98	73	56	56	47
West South Central	590	354	323	188	127	104	71	51	33	28
Mountain	444	405	241	179	193	113	97	100	79	70
Pacific	525	470	590	400	475	281	360	290	198	[4] 139

SCARLET FEVER CASES.

Total	1,966	1,737	1,796	1,658	1,532	1,612	1,555	1,508	1,330	1,217
New England	363	312	326	253	271	242	210	213	165	168
Middle Atlantic	532	517	498	474	467	473	470	452	406	380
East North Central	370	346	345	334	284	325	318	336	279	[1] 259
West North Central	254	184	230	222	195	197	219	223	182	167
South Atlantic	202	200	218	189	168	[2] 178	[2] 165	[3] 123	153	[3] 116
East South Central	30	11	18	16	12	16	19	9	9	8
West South Central	17	15	26	27	18	23	15	14	14	11
Mountain	28	16	20	19	23	27	37	25	30	17
Pacific	170	136	115	124	94	131	102	113	92	[4] 91

SMALLPOX CASES.

Total	602	544	536	467	568	543	460	529	408	334
New England	0	0	1	1	0	0	0	0	0	0
Middle Atlantic	6	1	1	0	0	0	0	5	1	1
East North Central	162	153	141	164	193	186	165	213	181	[1] 149
West North Central	72	52	61	41	62	53	33	39	26	19
South Atlantic	171	116	98	93	98	70	95	51	54	[3] 32
East South Central	38	49	45	26	55	49	20	54	33	36
West South Central	7	10	4	5	2	4	1	7	6	7
Mountain	7	8	4	10	6	5	6	6	3	7
Pacific	139	155	181	127	152	176	140	154	104	[4] 83

[1] Figures for Columbus, Ohio, estimated. Report not received at time of going to press.
[2] Figures for Wilmington, Del., estimated.
[3] Figures for Wilmington, Del., and St. Petersburg, Fla., estimated.
[4] Figures for Tacoma, Wash., estimated.

Summary of weekly reports from cities, March 23 to May 31, 1924—Continued.

TYPHOID FEVER CASES.

	1924, week ended—									
	Mar. 29	Apr. 5.	Apr. 12.	Apr. 19.	Apr. 26.	May 3.	May 10.	May 17.	May 24.	May 31.
Total	76	51	52	55	58	49	68	73	79	78
New England	4	1	4	4	7	4	9	2	6	9
Middle Atlantic	26	9	21	17	11	10	25	32	24	18
East North Central	7	7	7	7	10	11	9	12	7	[1] 6
West North Central	5	7	2	6	1	3	2	3	8	5
South Atlantic	11	9	10	4	8	11	11	8	[2] 19	[3] 13
East South Central	10	1	1	4	8	3	3	7	6	11
West South Central	8	9	2	4	6	3	3	3	5	10
Mountain	1	2	1	4	0	1	3	0	2	1
Pacific	4	6	4	5	7	3	3	6	2	[4] 5

INFLUENZA DEATHS.

Total	96	97	95	80	72	51	60	49	40	30
New England	3	6	3	3	3	2	2	1	2	1
Middle Atlantic	45	44	35	31	30	21	32	25	10	10
East North Central	11	20	25	14	12	7	10	5	11	[1] 10
West North Central	4	2	8	4	4	3	3	4	3	1
South Atlantic	10	3	7	6	10	5	7	5	6	[3] 5
East South Central	8	13	6	11	8	3	4	4	3	1
West South Central	10	6	3	4	3	4	0	3	1	1
Mountain	2	1	2	4	2	0	1	1	1	0
Pacific	3	2	6	3	0	6	1	1	3	[4] 1

PNEUMONIA DEATHS.

Total	1,204	1,251	1,222	1,101	959	938	785	743	647	632
New England	58	75	71	61	63	69	55	52	36	34
Middle Atlantic	525	560	494	474	430	392	332	343	285	267
East North Central	255	286	258	232	170	199	150	139	136	[1] 131
West North Central	72	71	74	64	49	53	42	41	38	40
South Atlantic	111	125	158	118	114	[2] 100	[2] 96	86	[2] 67	[3] 62
East South Central	47	61	53	57	42	44	29	22	32	40
West South Central	61	67	43	43	35	24	25	27	27	14
Mountain	37	39	32	25	26	27	24	13	11	18
Pacific	38	27	39	27	30	30	32	20	15	[4] 26

Number of cities included in summary of weekly reports and aggregate population of cities in each group, estimated as of July 1, 1923.

Group of cities.	Number of cities reporting cases.	Number of cities reporting deaths.	Aggregate population of cities reporting cases.	Aggregate population of cities reporting deaths.
Total	105	97	28,898,350	28,140,934
New England	12	12	2,098,746	2,098,746
Middle Atlantic	10	10	10,304,114	10,304,114
East North Central	17	17	7,032,535	7,032,535
West North Central	14	11	2,515,330	2,381,454
South Atlantic	22	22	2,566,901	2,566,901
East South Central	7	7	911,885	911,885
West South Central	8	6	1,124,564	1,023,013
Mountain	9	9	546,445	546,445
Pacific	6	3	1,797,830	1,275,841

[1] Figures for Columbus, Ohio, estimated. Report not received at time of going to press.
[2] Figures for Wilmington, Del., estimated.
[3] Figures for Wilmington, Del., and St. Petersburg, Fla., estimated.
[4] Figures for Tacoma, Wash., estimated.

FOREIGN AND INSULAR.

BRAZIL.

Epidemic Measles—Santos.

Reports received from Santos, Brazil, for the period January 28 to March 2, 1924, show continued [1] prevalence of measles in epidemic form at Santos, Brazil. This disease has been reported continuously present at Santos since August, 1923.

Lethargic Encephalitis.

One death from lethargic encephalitis was reported at Santos during the week ended February 10, 1924.

Plague—Porto Alegre.

Three cases of plague were reported at Porto Alegre, State of Sao Paulo, Brazil, during the two weeks ended April 26, 1924. It was stated under date of April 28 that plague-infected rats had been found at the railway station and that the station had been closed for two weeks in order to carry out measures of extermination. Plague was stated to have appeared in other localities in the State of Sao Paulo. Free rat poison had been offered to the inhabitants of many of the towns in the State, but only about 60 per cent of householders and firms were stated to have applied for the poison.

CANADA.

Communicable Diseases—Ontario—May, 1924 (Comparative).

Communicable diseases were reported in the Province of Ontario, Canada, during the month of May, 1924, as follows:

Disease.	May, 1924.		May, 1923.	
	Cases.	Deaths.	Cases.	Deaths.
Cerebrospinal meningitis	9	8	9	8
Chancroid	5		6	
Chicken pox	350		(a)	
Diphtheria	270	26	165	14
German measles	171		(a)	
Gonorrhea	75		209	
Influenza		14		47
Lethargic encephalitis	3	3	(a)	
Measles	4,577	13	2,359	14
Mumps	978	2	(a)	
Pneumonia		188		250
Scarlet fever	659	8	397	7
Septic sore throat	5	1	(a)	
Smallpox	32	2	17	
Syphilis	115		99	
Tuberculosis	217	105	221	118
Typhoid fever	56	2	89	24
Whooping cough	141	4	148	16

Population of Ontario, estimated, 1919—2,821,000.

a Not reported in 1923.

[1] Public Health Reports, Apr. 4, 1924, p. 722.

Distribution of Smallpox.

The occurrence of smallpox was reported in 11 localities of the Province. The greatest number of cases was notified at Ottawa, viz, 10; at Chatham 7 cases were notified; at Elizabethtown, 4; at Brockville, 3. The remaining localities reported each one case. The mortality from the disease was reported at Ottawa and Sudbury, viz, one death each.

CHILE.

Mortality from Broncho-Pneumonia—Iquique.

During the period December 3, 1923, to May 10, 1924, 87 deaths from broncho-pneumonia were notified at Iquique, Chile. Population, officially estimated, 40,000.

CUBA.

Communicable Diseases—Habana.

Communicable diseases have been notified at Habana as follows:

Disease.	May 21–31, 1924.		Remaining under treatment May 31, 1924.
	New cases.	Deaths.	
Cerebrospinal meningitis			1
Chicken pox	8		9
Diphtheria	3		2
Leprosy			15
Malaria	18		[1] 21
Measles	4		3
Typhoid fever	12	5	[2] 29

[1] From the interior, 11.

[2] From the interior, 15.

ECUADOR.

Plague—Smallpox—May 1–15, 1924.

During the period May 1 to 15, 1924, plague and smallpox were reported at Guayaquil, Ecuador, as follows: Plague—three cases; smallpox, one death. The death from smallpox occurred in a case notified during the period April 16 to 30, 1924, at quarantine. The patient had arrived on the steamship *Nitokris* from Valparaiso, Chile.[1]

Plague-Infected Rats—Guayaquil.

During the same period, 8,927 rats were reported taken at Guayaquil, and 29 rats found plague infected.

[1] Public Health Reports, May 30, 1924, page 1343.

FINLAND.

Communicable Diseases—January-April, 1924.

During the four-month period ended April 30, 1924, cases of communicable diseases were reported in Finland as follows:

Disease.	January, 1924.	February, 1924.	March, 1924.	April, 1924.	Total.
Diphtheria	187	155	142	104	588
Lethargic encephalitis	3	5	6	6	20
Poliomyelitis	3			4	7
Scarlet fever	197	267	240	255	899
Smallpox				1	1
Typhoid fever	27	26	15	44	112

Population officially estimated, 3,402,593.

Paratyphus Fever.

The occurrence of paratyphus fever was reported as follows: January, 1924, 3 cases; February, 10; March, 5; April, 16; total, 34 cases.

IRAQ (MESOPOTAMIA).

Plague—Bagdad—January-April, 1924.

During the months of January, February, and March, 1924, 6, 12, and 26 cases of plague, respectively, were reported at Bagdad, Iraq, making a total of 44 cases reported during the first quarter of the year. During the month of April, 1924, 26 cases were reported. For the spring months of the year 1923, 300 deaths from plague were reported at Bagdad.

Plague-Preventive Measures.

Under date of April 24, 1924, it was stated that inoculation had been made free at Bagdad and that 25,000 persons had been inoculated in March; rat destruction and disinfection against flea infestation were being carried out; and public notice of the necessity for plague precautions was being given through the press and by means of posters and the distribution of leaflets.

JAMAICA.

Smallpox (Reported as Alastrim).

Smallpox (reported as alastrim) has been notified in the Island of Jamaica as follows: Week ended May 10, 1924, new cases, 29; May 17, 1924, new cases 43, of which 11 cases were notified in the parish of Kingston.

Chicken Pox.

During the week ended May 10, 1924, one case of chicken pox was reported in the island of Jamaica.

NICARAGUA.

Typhoid Fever—Bluefields.

During the four-week period ended May 24, 1924, typhoid fever was reported prevalent at Bluefields, Nicaragua.

PERU.

Plague—April, 1924.

During the month of April, 1924, 56 cases of plague with 29 deaths were reported in Peru. The occurrence was reported in seven towns, two districts, and on country estates. For distribution of occurrence according to locality, see page 1539.

POLAND.

Communicable Diseases—February 10–23, 1924.

Communicable diseases were reported in Poland during the period February 10 to 23, 1924, as follows:

February 10–16, 1924.

Disease	Cases	Deaths	District showing greatest number of deaths
Cerebrospinal meningitis	5	4	Warsaw and Lodz.
Diphtheria	84	16	Lodz and Silesia.
Measles	551	5	Tarnopol.
Scarlet fever	319	27	Lwow and Stanislawow.
Smallpox	38	9	Krakow.
Tuberculosis	165	248	Warsaw.
Typhoid fever	233	33	Lodz and Lwow.
Typhus fever	249	17	Tarnopol.
Typhus fever, recurrent	15		
Whooping cough	51	10	Warsaw.

February 17–23, 1924.

Cerebrospinal meningitis	11	10	Lodz.
Diphtheria	91	14	Do.
Measles	283	3	Lwow.
Scarlet fever	273	27	Stanislawow.
Smallpox	28	5	Kielce.
Tuberculosis	141	273	Warsaw.
Typhoid fever	260	27	Do.
Typhus fever	254	24	Lwow.
Typhus fever, recurrent	19	4	Stanislawow.
Whooping cough	134	13	Warsaw.

Dysentery—Rabies.

During the two weeks under report 29 cases of dysentery with 4 deaths and 3 deaths from rabies were reported in Poland.

UNION OF SOUTH AFRICA.

Plague—Orange Free State.

During the week ended April 26, 1924, 12 new cases of plague with 8 deaths were reported in the Orange Free State, Union of

South Africa. Of these, 1 case occurred in the white population and 11 cases with 8 deaths in the native population. One death (native) occurred in a case reported for the preceding week. The total number of cases reported from the date of the outbreak, December 16, 1923, to April 26, 1924, was 320, with 193 deaths. For distribution of occurrence according to color, see table below.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER.

The reports contained in the following tables must not be considered as complete or final as regards either the lists of countries included or the figures for the particular countries for which reports are given.

Reports Received During Week Ended June 20, 1924.[1]

CHOLERA.

Place	Date	Cases	Deaths	Remarks
India				Apr. 13-19, 1924: Cases, 10,854; deaths, 8,014.
Calcutta	Apr. 27-May 10	153	133	
Madras	May 4-10	1	1	
Rangoon	Apr. 19-May 3	12	9	
Indo-China:				
Saigon	Apr. 20-26	1		
Siam:				
Bangkok	Apr. 22-28	1		

PLAGUE.

Brazil:				
Porto Alegre	Apr. 13-26	3		Plague-infected rats found at railway station.
Ceylon:				
Colombo	Apr. 27-May 3	2	4	One plague rat.
Ecuador:				
Guayaquil	May 1-15	3		Rats taken, 8,927; found infected, 29.
India				Apr. 13-19, 1924: Cases, 19,465; deaths, 15,590.
Bombay	Apr. 20-May 3	47	37	
Calcutta	Apr. 27-May 10	7	7	
Karachi	May 4-10	11	9	
Madras Presidency	do	6	2	
Rangoon	Apr 19-May 3	38	36	
Indo-China:				
Saigon	Apr 20-26	3	1	
Iraq:				
Bagdad	Apr 1-30	26		Jan.-Mar., 1924: Cases, 44. In spring months of 1923, 300 deaths reported.
Peru				Apr. 1-30, 1924: Cases, 56; deaths, 29.
Locality—				
Cajamarca	Apr. 1-30	29	17	In districts.
Callao	do	4	5	
Cañete	do	1	1	Do.
Chiclayo	do	2		
Chincha	do	3	1	
Lima	do	11	5	City
Mollendo	do	1		
Pacora	do	2		
Pativalea	do	2		
Truʻillo	do	1		Country estates.
Union of South Africa:				
Orange Free State				Apr. 20-26, 1924: Cases, 12; deaths, 8. (White, 1 case; native, 11 cases, 8 deaths.) Total, Dec. 16, 1923-Apr. 26, 1924: Cases, 320 (white, 46; native, 274.) Deaths, 193 (white, 21; native, 172).

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received During Week Ended June 20, 1924.

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Arabia:				
Aden	May 11-17	1		
Brazil:				
Porto Alegre	May 4-10		1	
Rio de Janeiro	do	1	1	
Canada:				
Alberta—				
Calgary	May 25-31	4		
British Columbia—				
Vancouver	do	12		
Ontario				May 1-31, 1924: Cases, 32; deaths, 2.
Ceylon:				
Colombo	Apr. 27-May 3	1		
China:				
Amoy	do		1	
Antung	May 12-18	1		
Chungking	Apr. 27-May 3			Present.
Hongkong	Mar. 30-Apr. 19	42	37	
Shanghai	Apr 27-May 3	1	1	
Chosen (Korea):				
Seoul	Apr. 1-30	1		
Ecuador:				
Guayaquil	May 1-15		1	
Finland				Apr. 1-30, 1924: One case, one death.
Great Britain:				
England and Wales	Dec. 30-May 24	1,872		
India				Apr. 13-19, 1924: Cases, 3,409; deaths, 855.
Bombay	Apr. 20-May 3	190	104	
Calcutta	Apr. 27-May 10	5	5	
Karachi	May 4-10	12	10	
Madras	do	4	1	
Rangoon	Apr. 20-May 3	16	2	
Indo-China:				
Saigon	Apr. 20-26	19	7	
Jamaica				May 3-17 1924: Cases, 72 (reported as alastrim.)
Kingston	May 11-17	11		
Java:				
East Java—				
Soerabaya	Mar. 30-Apr. 12	66	19	
West Java—				
Batavia	Apr. 12-18	11	2	
Mexico:				
Mexico City	Apr. 20-26	36		Including municipalities in the Federal District.
Tampico	May 21-31	7	2	
Poland				Feb. 4-23, 1924: Cases, 66; deaths, 14.
Senegal:				
Dakar	Apr. 1-30	1		
Siam:				
Bangkok	Apr. 22-28	1		
Spain:				
Valencia	May 18-24	5		
Straits Settlements:				
Singapore	Apr. 20-26	1		
Switzerland:				
Basel	May 11-17	1		
Berne	May 11-17	1		
Turkey:				
Constantinople	May 11-17	1		
Union of South Africa:				
Cape Province	Apr. 20-26			Outbreaks.

TYPHUS FEVER.

Chosen (Korea):				
Seoul	Apr. 1-30	30	7	
Egypt:				
Alexandria	May 7-13	1		
Finland				Jan.-Apr., 1924: Paratyphus fever: Cases, 34.
Mexico:				
Mexico City	Apr. 20-26	4		Including municipalities in Federal District.
Poland				Feb. 4-23, 1924: Cases, 503; deaths, 41. Recurrent typhus, cases, 34; deaths, 4.
Union of South Africa:				
Cape Province	Apr. 20-26			Outbreaks.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924.[1]

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Hongkong	Nov. 18–24	1		
India				Oct. 14–Dec. 22, 1923: Cases, 14,117; deaths, 9,148.
Do				Dec. 30, 1923–Apr. 12, 1924: Cases, 36,424; deaths, 23,394.
Bombay	Dec. 23–29	1	1	
Do	Feb. 3–Apr. 19	19	19	
Calcutta	Nov. 11–Dec. 29	85	69	
Do	Dec. 30–Apr. 12	815	593	
Madras	Nov. 25–Dec. 29	15	5	
Do	Dec. 30–Apr. 12	26	12	
Rangoon	Nov. 11–Dec. 29	8	5	
Do	Feb. 24–Apr. 6	17	15	
Indo-China:				
Saigon	Dec. 31–Apr. 19	5	5	Including 100 square kilometers of surrounding country.
Philippine Islands:				
City—				
Manila	Feb. 3–9	1	1	
Province—				
Cebu	Mar. 2–8	1	1	
Siam:				
Bangkok	Nov 18–Dec. 8	4	2	
Do	Dec. 31–Apr. 19	15	8	
Turkey:				
Constantinople	Dec. 2–8		1	

PLAGUE.

Azores:				
St. Michael Island	Oct. 20–Nov. 10	9	5	At localities 3 to 9 miles from port of Ponta Delgada.
Bolivia:				
La Paz	Oct. 1–31		3	
Do	Feb. 1–Mar. 31		10	
Brazil:				
Bahia	Nov. 11–Dec. 22	5	3	
Do	Dec. 30–Mar. 15	7	6	
Porto Alegre	Feb. 10–Apr. 26	3	3	
Rio de Janeiro	Jan. 20–26	1		
British East Africa:				
Kenya—				
Kisumu	Feb. 24–Mar. 8	1	1	
Mombasa	Oct. 14–20	1	1	Infected rats, 2. Dec. 9–15, 1923: Cases, 4; deaths, 2; removed from vessel arrived Dec. 11, 1923.
Do	Dec. 30–Jan. 5	1	1	
Nairobi	Nov. 1–21	40		In rural districts, several hundred.
Tanganyika				To Nov. 24, 1923: Cases, 39, deaths, 25.
Do	Jan. 27–Feb. 9	8	5	
Uganda	Aug. 1–Oct. 31	734	719	
Entebbe	Oct. 1–Dec. 31	251	239	
Do	Jan. 1–31	36	35	
Canary Islands:				
Las Palmas	Oct. 15–Nov. 15	14	14	
Santa Cruz de Teneriffe	Feb. 19–May 16	7	1	Bubonic and septicemic.
San Juan de la Rambla	Dec. 11	1		Locality 52 km. from Teneriffe.
Celebes Island	Mar. 30			Epidemic.
Macassar	Feb. 20–Mar. 8	11	7	Including Menado.
Ceylon:				
Colombo	Nov. 11–Dec. 29	31	21	Plague rodents, 24.
Do	Dec. 30–Apr. 26	104	99	Plague rodents, 44.
Chile:				
Antofagasta	Mar. 16–Apr. 12	10	1	
China:				
Antung	Mar. 31–Apr. 6	1		
Nanking	Dec. 16–29			Present.
Do	Dec. 30–Apr. 5			Do.
Ecuador:				
Eloy Alfaro	Mar. 16–31	1	1	
Guayaquil	Nov. 16–Dec. 31	45	13	Rats taken, 53,240; found infected, 133.

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Equador—Continued				
Guayaquil	Jan. 1–Apr. 30	112	35	Rats taken, 119,457; found infected, 520.
Jipijapa	Nov. 16–Dec. 15			Present.
Posorja	Apr. 1–30	6	1	
Quevedo	Jan. 1–31	3	2	
Quito	Nov. 1–30	11	1	
Santa Rosa	Feb. 16–29			Do.
Vino del Milagro	Dec. 1–15	1		
Egypt				Jan. 1–Dec. 31, 1923: Cases, 1,519; deaths, 725. Jan. 1–May 1, 1924: Cases, 204; deaths, 149.
City—				
Alexandria	Year 1923	65	33	
Do	Apr. 2	1	1	
Cairo	Year 1923	2	2	
Port Said	do	51	29	
Do	Apr. 24	1		
Suez	Year 1923	46	24	
Do	Jan. 2–Apr. 28	14	7	
Province—				
Assiout	Year 1923	370	211	
Do	Apr. 1–May 1	27	19	
Beni-Souef	Year 1923	63	23	
Charkieh	Jan. 31–Mar. 27	3	3	
Dakhalieh	Year 1923	2	2	
Fayoum	do	34	9	
Do	Feb. 18–May 1	48	10	
Gharbieh	Year 1923	23	9	
Do	Apr. 21	1	1	
Girgeh	Year 1923	337	193	
Do	Jan. 17–Apr. 25	14	6	
Gizeh	Year 1923	3	4	
Kalioubiah	do	76	10	
Do	Jan. 6–Mar. 27	1		
Kena	Year 1923	50	34	
Do	Apr. 9–29	41	29	
Menoufieh	Year 1923	200	98	
Do	Jan. 2–Apr. 21	94	58	
Minia	Year 1923	106	44	
Do	Feb. 5–Apr. 8	11	9	
Greece:				
Kalamata	Apr. 18–24			Several deaths.
Patras	do			Do.
Hawaii, Territory of:				
Honokaa				Jan. 8–Mar. 14, 1924: Four plague-infected rodents.
Do	May 10			One plague-infected rodent.
Paauhau				Dec. 14, 1923: One plague rat. Feb. 14, 1924: One plague rat.
India				Oct. 14–Dec. 29, 1923: Cases, 34,542; deaths, 23,778.
Do				Dec. 30, 1923–Apr. 12, 1924: Cases, 124,666; deaths, 95,552.
Bombay	Oct. 28–Dec. 22	5	5	Corrected report.
Do	Dec. 30–Apr. 19	311	248	
Calcutta	Dec. 23–29	1	1	
Do	Jan. 6–Apr. 26	107	14	
Karachi	Nov. 11–Dec. 29	42	33	
Do	ec. 30–May 3	91	74	
Madras Presidency	Nov. 4–Dec. 29	1,657	1,021	
Do	Jan. 27–May 7	669	432	
Rangoon	Jan. 27–Feb. 16	20	15	
Do	Dec. 30–Apr. 19	169	155	
Indo-China:				
Saigon	Oct. 28–Dec. 8	19	6	Including 100 square kilometers of surrounding country.
Do	Jan. 27–Apr. 19	2	1	Including 100 square kilometers of surrounding country. One plague rodent.
Iraq (Mesopotamia):				
Bagdad	Nov. 11–Dec. 29	8	6	
Do	Jan. 6–Apr. 19	67	38	Corrected report.
Java				Oct. 1–Dec. 31, 1923: Deaths, 2,908. Jan. 1–Feb. 29: Deaths, 1,732.
East Java—				
Djokjakarta	Oct. 4–Dec. 31		146	
Do	Jan. 1–Feb. 29		92	
Kedoe	Oct. 1–Dec. 31		1,287	
Do	Jan. 1–Feb. 29		626	
Pasoeroean	Feb. 1–29		3	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Java:				
East Java—Continued				
Pekalongan	Oct. 1–Dec. 31		150	
Do	Jan. 1–Feb. 29		107	
Samarang	Oct. 1–Dec. 31		430	
Do	Jan. 1–Feb. 29		183	
Soerabaya	Oct. 1–Dec. 31		9	
Do	Jan. 1–Feb. 29		17	Plague rats, 5.
Soerakarta	Oct. 1–Dec. 31		886	
Do	Jan. 1–Feb. 29		704	Corrected report.
Madagascar:				
Tananarive Province	Oct. 1–Dec. 31	324	272	Bubonic, pneumonic, septicemic. July 1–Dec. 31, 1923—city and Province: Cases, 429; deaths, 367. Jan. 1–Mar. 31, 1924—city and Province: Cases, 729; deaths, 667.
Ambatondrazaka	Feb. 1–15	8		District. Type pneumonic.
Ambositra	Feb. 1–29	8	1	Do.
Tananarive town	Oct. 1–Dec. 31	74	74	
Do	Jan. 29–Mar. 31	43	42	
Other localities	Feb. 1–Mar. 31	415	398	
Paraguay:				
Asuncion	Dec. 18	6	4	
Peru				Nov. 1–Dec. 31, 1923: Cases, 38; deaths, 24. Jan. 1–Mar. 31, 1924: Cases, 162; deaths, 49.
Locality—				
Ayabaca	Mar. 1–31	4		
Barranco	do	1		
Callao	Jan. 1–Mar. 31	7	2	
Cañete	Nov. 1–30	1	1	
Do	Feb. 1–Mar. 31	14	5	
Casma	Mar. 1–31	2	1	
Chancay	Dec. 1–31	2		
Chepen	Nov. 1–30	1		
Chiclayo	Nov. 1–Dec. 31	2	1	
Chilca	Jan. 1–31	1		
Guadalupe	Feb. 1–Mar. 31	3	1	
Huacho	do	5	3	
Huaral	do	11	4	
Huarmey	Jan. 1–Mar. 31	22	4	
Lambayeque	Mar. 1–31	2		
Lima (city)	Nov. 1–Dec. 31	22	15	
Do	Jan. 1–Mar. 31	41	21	
Lima (country)	Nov. 1–Dec. 31	8	7	
Do	Jan. 1–Mar. 31	11	2	
Lurin	do	2		
Mollendo	do	3	2	
Moro	Mar. 1–31	7		
Paita (city)	Jan. 1–Mar. 31	1	1	
Paita (country)	do	8	1	
Reque	do	4		
Salaverry	Mar. 1–31	1		
Sullana	Jan. 1–Mar. 31	2		
Trujillo	do	12	2	Country.
Portugal:				
Lisbon	Dec. 13–21	7		
Do	Dec. 31–Jan. 6		1	
Portuguese West Africa:				
Angola—				
Loanda	Oct. 1–Dec. 29	59	29	
Do	Dec. 30–Feb. 2		4	
Russia:				
Bukeeve Province				Oct. 1, 1923–Mar. 10, 1924: Cases, 339; deaths, 315; 66 plague centers. Entire southeast section: Cases, 473; deaths, 435.
Ural Provinces				Oct. 1, 1923–Feb. 4, 1924: Cases, 441; 4 plague centers.
Kalmuk district	Mar. 10	3		
Novy Kazanka	Mar. 1		4	At a locality on the coast; 16 cases, 8 deaths.
Siam:				
Bangkok	Nov. 4–Dec. 8	3	2	
Do	Jan. 13–Mar. 22	5	5	
Siberia:				
Transbaikalia—				
Chita	Jan. 27	2	2	Pneumonic. Occurring in veterinary laboratory workers.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Spain:				
Malaga	Dec. 1-31	4		
Straits Settlements:				
Penang	Jan. 27-Feb. 2	1	1	
Singapore	Nov. 11-Mar. 15	4	4	
Do	Dec. 30-Apr. 12	17	13	
Syria:				
Beirut	Nov. 1-Dec. 10	3		
Do	Jan. 1-Mar. 31	3		
Turkey:				
Constantinople	Dec. 2-22	6	3	
Union of South Africa				Dec. 16, 1923-Apr. 19, 1924: Cases, 308, deaths, 184. (White cases, 45; deaths, 21.) Native cases, 263; deaths, 163.
Cape Province				Reported Mar. 17, 1924: Cases, 11; deaths, 7.
Uitenhage district	Dec. 9-15			Plague rodent found in vicinity Haarhoff's Kraal farm.
Orange Free State				Jan. 6-Mar. 8, 1924; cases, 132; deaths, 69.
Thaba 'Nchu				Mar. 23-29, 1924: One plague rat.
Hoopstad district	Feb. 3-9	1		
Kroonstad district	Dec. 16-27	7	3	
Do	Jan. 6-Feb. 9	43	20	
Winburg district	Feb. 3-9	1		
Wonderfontein farm	Dec. 2-8	4		Vicinity of Hoopstad. At Hoopstad, Dec. 9-15, 1923, one death of case previously reported.
Transvaal—				
Wolmaransstad district	Mar. 2-8	3	1	White, one case.
West Africa				Apr. 2, 1924: Reported present in one locality.
On vessels:				
———	Dec. 11	4	2	At Mombasa, British East Africa.
———	Jan. 24	2		At Varna, Bulgaria, from Syrian port.

SMALLPOX.

Algeria:				
Algiers	Nov. 1-30	1		
Do	Mar. 1-Apr. 30	2		
Arabia:				
Aden	Dec. 16-22	1		Imported.
Do	Jan. 13-Apr. 19	8		Four imported.
Belgium:				
Brussels	Jan. 13-Mar. 29	10		
Bolivia:				
La Paz	Oct. 1-Dec. 31	45	15	
Do	Jan. 1-Apr. 30	39	25	
Brazil:				
Bahia	Jan. 6-12	2		
Pernambuco	Nov. 4-Dec. 1	15	3	
Do	Jan. 6-Feb. 23		8	
Porto Alegre	Dec. 23-29		1	
Do	Dec. 30-Apr. 12		3	
Rio de Janeiro	Nov. 18-24	3	4	
Do	Jan. 6-May 3	6	3	
Sao Paulo	Sept. 3-9	1		
British East Africa:				
Tanganyika Territory	Sept. 30-Dec. 29	30	7	
Do	Jan. 6-12	2		
Uganda	Sept. 1-30	6	1	
Entebbe	Oct. 1-Dec. 31	5	1	
Zanzibar	Sept. 1-Oct. 31	116	18	Sept. 1-30, 1923: In areas 27 miles from town of Zanzibar. Oct. 1-31, 1923: In vicinity, 1 case, 1 death. In Mikotoni district, 30 cases, 14 deaths reported.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
British South Africa:				
Northern Rhodesia				Dec. 4–31, 1923: Cases, 40; deaths, 5.
Do	Feb. 26–Apr. 7	3		Jan. 1–31, 1924: Cases, 50; deaths, 11; reported from Balorale, Kalabo, and Mankoya districts.
Canada:				
Alberta—				
Calgary	Jan. 27–May 24	47		
British Columbia—				
Vancouver	Dec. 22–29	10		
Do	Dec. 30–May 24	137		
Victoria	Feb. 10–Mar. 29	3		
Manitoba—				
Winnipeg	Nov. 25–Dec. 29	21		
Do	Dec. 30–May 31	82		
New Brunswick—				
Fredericton				Feb. 1–29, 1924: Cases, 8.
Gloucester County	Mar. 2–Apr. 5	4		
Madawaska County	Dec. 8–15	1		
Restigouche County	Apr. 20–26	1		Jan. 1–Mar. 31, 1924: Cases, 5.
Victoria County	Feb. 10–16	2		
Westmoreland County	Feb. 10–Apr. 26	5		
Ontario				Jan. 1–Apr. 30, 1924: Cases, 397; deaths, 31.
Amherstburg	Mar. 1–31	16	8	
Chapleau	do	13	1	
Cochrane	do	15	5	
Essex Border	do	12	6	
Fort William and Port Arthur.	Dec. 16–29	3		Occuring at Fort William.
London	Feb. 3–Apr. 5	9		
North Bay	do	1		
Perth	Mar. 1–31	14		
Toronto	Jan. 17–Mar. 31	15		
Ottawa	Feb. 17–May 31	19	1	
Windsor	Feb. 1–Mar. 15	52	11	
Quebec—				
Montreal	Nov. 30–Feb. 23	7		
Saskatchewan—				
Regina	Dec. 9–15	1		
Do	Dec. 30–Feb. 23	6	1	
Saskatoon	May 18–24	1		
Ceylon:				
Colombo	Nov. 11–17	3	1	
Do	Jan. 20–Apr. 12	6	1	
Chile:				
Antofagasta	Jan. 6–May 3	7	1	
Concepcion	Oct. 1–Dec. 31		14	
Talcahuano	Nov. 26–Dec. 2	3		Dec. 22, 1923: Five cases present.
Valparaiso	Dec. 9–15		1	
Do	Jan. 13–Mar. 10		18	
China:				
Amoy	Nov. 18–Dec. 8		11	
Do	Jan. 6–Apr. 26		16	Including Kulangsu, 14 deaths; and in hospital, Feb. 9, 1924, more than 30 cases stated to be present.
Antung	Dec. 31–May 4	6	2	
Canton	Dec. 23–Feb. 23			Present.
Chungking	Nov. 4–Dec. 29			Present and endemic.
Do	Dec. 30–Apr. 26			Stated to be endemic.
Foochow	Nov. 4–Dec. 15			Present.
Do	Dec. 31–Apr. 26			Do.
Hongkong	Oct. 28–Dec. 29	769	680	
Do	Dec. 30–Mar. 29	604	613	
Manchuria—				
Dairen	Dec. 31–Jan. 20	2		
Do	Mar. 3–Apr. 20	4	1	
Harbin	Nov. 12–Dec. 22	36		
Do	Jan. 1–Mar. 17	19	5	
Nanking	Dec. 2–15			Do.
Do	Dec. 30–May 3			Do.
Shanghai	Dec. 29			Prevalent.
Do	Jan. 6–Apr. 26	33	78	Cases, foreign; deaths, Chinese and foreign.
Tientsin	Mar. 23–May 3	6		Reported by mission and British municipality; one mission hospital.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Chosen (Korea):				
Chemulpo	Jan. 1-31	1		
Seoul	Nov. 1-30	1		
Do	Feb. 1-Mar. 31	5		
Colombia:				
Barranquilla	Apr. 6-12		2	
Buenaventura	Nov. 18-Dec. 15	8		
Do	Apr. 3-12	3		
Costa Rica:				
Port Limon	Feb. 18-Apr. 5	2		
Czechoslovakia				Oct. 1-Dec. 31, 1923: Cases, 1; deaths 1, occurring in Slovakia. Mar. 1-31, 1924; one case.
Dominican Republic:				
La Romana	Jan. 27-Mar. 22	14		
Ecuador:				
Esmeraldas	Nov. 16-30	4		
Guayaquil	Dec. 1-31	1		
Do	Jan. 1-Feb. 29	3		
Milagro	Apr. 1-15	1		
Quito	Nov. 1-30	167	26	
Egypt:				
Alexandria	Feb. 27-May 6	5	7	
Cairo	Jan. 1-Feb. 11	3	1	
Port Said	Nov. 24-Dec. 2	1		
Do	Apr. 16-22	2		Imported.
Esthonia				Nov. 1-Dec. 31, 1923: Cases, 38. Jan. 1-Mar. 31, 1924: Cases, 16.
Finland				Apr. 1-15: 1 case.
France:				
Cherbourg	Feb. 9-15	1		British seaman.
Gibraltar	Mar. 3-Apr. 13	2		
Great Britain:				
Liverpool	Mar. 2-8	1		In family of seaman recently returned from Oporto, Portugal.
Sheffield	May 11-17	2		
Greece:				
Saloniki	Oct. 22-Dec. 30		11	
Do	Dec. 31-Apr. 20	31	24	
Guadeloupe (West Indies)				Jan. 2-16, 1924: Present.
Abymes	Feb. 16			Present. Vicinity of Point à Pitre.
Basse Terre	Dec. 18			Present.
Do	Jan. 12-Feb. 16			Do.
Marie Galante Island	Dec. 18			Off shore Island. Present. Estimated 60 cases.
Do	Feb. 16			Present.
Moule	Jan. 12-Feb. 16			Present.
Point à Pitre	Dec. 18			Present in vicinity.
Haiti:				
Cape Haitien	Feb. 3-Apr. 26	4		Mar. 9-15, 1924: Two cases in hospital.
Hinche	Feb. 10-16	1		
Port au Prince	Feb. 17-May 3	5	1	Developed at Limbe, Haiti.
India				Oct. 14-Dec. 29, 1923: Cases, 9,720; deaths, 2,241.
Do				Dec. 30, 1923-Apr. 12, 1924: Cases, 50,634; deaths, 10,175.
Bombay	Oct. 28-Dec. 29	55	25	
Do	Dec. 30-Apr. 19	1,182	595	
Calcutta	Dec. 16-29	4	4	
Do	Dec. 30-Apr. 26	28	25	
Karachi	Dec. 30-May 3	184	68	
Madras	Nov. 4-Dec. 29	23	3	
Do	Dec. 30-May 7	340	37	
Rangoon	Nov. 4-Dec. 29	12	4	
Do	Dec. 30-Apr. 19	73	27	
Indo-China:				
City—				
Saigon	Nov. 4-Dec. 29	133	74	Including 100 square kilometers of surrounding country.
Do	Dec. 31-Apr. 19	834	473	
Iraq (Mesopotamia):				
Bagdad	Oct. 24-Dec. 29	46	28	
Do	Dec. 30-Apr. 12	45	33	
Italy:				
Treviso	Apr. 1-15	15		Estimated.
Trieste	Feb. 17-23	4		
Turin	Feb. 18-24	1		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Jamaica				Nov. 25–Dec. 29, 1923: Cases, 115
Do				Dec. 30, 1923–May 3, 1924: Cases,
Kingston	Nov. 25–Dec. 29	3		443. Reported as alastrim. De-
Do	Dec. 30–Apr 26	17		layed report for Feb. 17–23,
				1924, 1 case.
Japan:				
Kobe	Feb. 14–May 12	18	7	
Nagoya	Apr. 6–12	3	1	
Taiwan	Jan. 1–Mar. 31	8		
Tokyo	Jan. 1–Apr. 12	136		
Yokohama	Mar. 30–May 4	3		
Java:				
East Java—				
Patjiram	Mar. 8			Epidemic.
Soerabaya	Oct. 31–Dec. 29	348	60	
Do	Dec. 30–Mar. 29	276	61	
West Java—				
Batavia	Oct. 27–Dec. 28	65	13	
Do	Dec. 29–Apr. 11	67	8	
Latvia				Oct. 1–Dec. 31, 1923: Cases, 6;
				Jan. 1–Mar. 31, 1924: Cases, 11.
Lithuania				Mar. 1–31, 1924: Cases, 36;
				deaths, 11.
Malta	Feb. 1–29	1		
Mexico:				
Durango	Apr. 1–30		2	
Guadalajara	Jan. 27–May 17	5	10	
Manzanillo	Dec. 4–10	5	1	
Mazatlan	Mar. 31–Apr. 13		4	Apr. 21, 1924: Cases from 25–35
				In city and vicinity. No mor-
				tality reported.
Mexico City	Nov. 25–Dec. 29	32		Including municipalities in Fed-
				eral District.
Do	Dec. 30–Apr. 19	147	23	Do.
Monterey				Mar. 24, 1924, 11 cases officially
				announced.
Salina Cruz	Jan. 1–Apr. 30	5	4	Nine cases chicken pox present.
San Luis Potosi	Mar. 16–22		1	
Tampico	Jan. 21–May 20	47	4	From Irapuato, 9; La Barra, 1.
Vera Cruz	Nov. 3–Dec. 30		4	Jan. 21–Apr. 10, 1924: Cases, 36
Do	Jan. 6–Apr. 20	2	7	(12 in soldiers or soldiers' fam-
				ilies); deaths, 5.
Netherlands:				
Rotterdam	Jan. 20–26	3		
Palestine:				
Jaffa	Jan. 15–28	3		
Jerusalem	Feb. 18–25	1		
Persia:				
Teheran	Sept. 24–Dec. 23		4	
Do	Dec. 22–Jan. 31		2	
Poland				Sept. 23–Dec. 31, 1923: Cases, 83:
				deaths, 20. Jan. 1–Feb. 9, 1924:
				Cases, 275; deaths, 27.
Portugal:				
Lisbon	Nov. 11–Dec. 29	19	10	Corrected report.
Do	Dec. 31–May 17	101	19	
Oporto	Nov. 25–Dec. 29	39	23	
Do	Dec. 30–May 10	111	59	
Portuguese East Africa:				
Lourenco Marques	Dec. 30–Jan. 5	2		
Portuguese West Africa:				
Angola—				
Loanda	Dec. 2–29		5	
Russia:				
Ukraine				Aug. 1–Sept. 30, 1923: Cases, 143.
Siam:				
Bangkok	Oct. 28–Dec. 8	33	18	Nov. 25–Dec. 1, 1923; Epidemic.
Do	Dec. 30–Apr. 19	14	2	Imported.
Siberia:				
Dauria Station	Oct. 21			Present. Locality on Chita Rail-
				way, Manchurian frontier.
Sierra Leone:				
Sherbro District—				
Tagbail	Nov. 1–15	3		
Spain:				
Barcelona	Nov. 15–Dec. 26		2	
Do	Jan. 3–Mar. 26		5	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Spain—Continued.				
Cadiz	Mar. 1-31	2		
Valencia	Nov. 25-Dec. 29	152	12	
Do	Dec. 30-May 17	448	38	
Straits Settlements:				
Penang	Mar. 16-29	2	2	
Singapore	Dec. 16-29	2	1	
Do	Dec. 30-Mar. 29	5		
Switzerland:				
Basel	Jan. 27-Feb. 9	4		Corrected.
Berne	Nov. 17-Dec. 22	15		
Do	Jan. 6-May 10	40	1	
Lucerne	Nov. 1-Dec. 31	60		
Do	Jan. 1-Apr. 30	50		
Zurich	Jan. 27-May 10	3		
Syria:				
Aleppo	Nov. 25-Dec. 1	1		In vicinity, at Djsr Choughour.
Beirut	Jan. 21-Feb. 20	2		
Damascus	Nov. 16-Dec. 15	7		
Do	Jan. 29-Apr. 28	40		
Tunis:				
Tunis	Oct. 27-Nov. 2	5	1	
Do	Jan. 8-May 19	14	7	
Turkey				Dec. 1-31, 1923: Cases, 120; deaths, 15.
Constantinople	Nov. 11-Dec. 8	3		
Do	Jan. 6-Apr. 5	4	1	
Union of South Africa				Oct. 1-31, 1923: Colored, cases, 41; deaths, 2; white, cases, 3. Feb. 1-29, 1924: Cases, 71 (white, 6); 1 death.
Cape Province	Oct. 28-Dec. 8			Outbreaks.
Do	Jan. 20-Apr. 19			Do.
Natal	Oct. 28-Nov. 3			Do.
Do	Mar. 16-22			Do.
Orange Free State	Oct. 28-Nov. 24			Do.
Do	Jan. 20-Apr. 19			Do.
Transvaal	Nov. 18-Dec. 1			Do.
Do	Mar. 11-17			Do.
Johannesburg	Nov. 25-Dec. 15	3		
Do	Feb. 3-23	2		
Uruguay:				
Montevideo	Oct. 1-31	1		
Venezuela:				
Caracas	Jan. 22			Epidemic.
Margarita Island—				
Punta Piedra	Mar. 21	60		20 miles from mainland.
On vessels:				
Steamship Coppename	Mar. 19	1		At New Orleans from Puerto Barrios, Guatemala.
U. S. naval hospital ship Mercy.	Apr. 1	1		At St. Thomas, Virgin Islands, from Culebra, P. I. Patient had been in Jamaica, West Indies, two weeks previous. Case reported as alastrim.
S. S. Nitokris	Apr. 30	1		At Guayaquil, from Valparaiso, Chile. Under treatment at lazaretto.
S. S. Torres	Jan. 14	1		At New Orleans quarantine station from Tampico, Mexico, via ports. Case in seaman signed on at Galveston, Tex., on outward voyage.
S. S. Tupper	Jan. 20-26	1		At Gonaives, Haiti.
S. S. Vasari	Dec. 31	1		At Trinidad, West Indies, from Buenos Aires, Argentina. Vessel left Buenos Aires Dec. 15, 1923, for New York, via Santos, Rio de Janeiro, Trinidad, Barbados.
Sch. Annie M. Parker	Jan. 23	3		At sea. Vessel abandoned and crew removed to vessel bound for Rotterdam. Patients removed at Liverpool Feb. 28, bound for Newfoundland.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

TYPHUS FEVER.

Place.	Date.	Cases.	Deaths.	Remarks.
Algeria:				
Algiers	Nov. 1-Dec. 31	7	3	
Do	Jan. 1-Mar. 31	21	7	
Bolivia:				
La Paz	Oct. 1-Dec. 31	43	5	
Do	Jan. 1-Apr. 30	41	4	
Brazil:				
Porto Alegre	Feb. 24-Mar. 1		1	
Bulgaria:				
Sofia				Nov. 18-Dec. 15, 1923: Paratyphus fever, cases, 17. Jan. 6-Apr. 19, 1924: Paratyphus fever, cases, 11.
Canary Islands:				
Santa Cruz de Teneriffe	Jan. 14-Feb. 17		2	
Ceylon:				
Colombo	Feb. 24-Mar. 1	1	1	Case from port, 1.
Chile:				
Antofagasta	Dec. 2-8	4		
Do	Apr. 6-12	2		
Concepcion	Oct. 1-Nov. 30		4	Dec. 11-24, 1923: Deaths, 3.
Do	Jan. 8-Apr. 21	5	13	In district, at 12 localities, 92 cases.
Iquique	Jan. 20-26		1	
Talcahuano				Dec. 5, 1923: 3 cases under treatment. Jan. 12, 1924: 1 case under treatment.
Do	Jan. 31-May 3	9	4	
Valparaiso	Nov. 25-Dec. 15		29	Dec. 24, 1923: In hospital, 34 cases.
Do	Dec. 30-Mar. 15		44	Reports from two districts of the Province of Valparaiso.
China:				
Antung	Nov. 12-Dec. 30	5		
Chungking	Nov. 18-24			Present.
Do	Dec. 16-29			Endemic.
Do	Dec. 30-Feb. 16			Do.
Manchuria—				
Harbin	Mar. 18-24		1	
Chosen (Korea):				
Chemulpo	Feb. 1-Mar. 31	5	3	
Seoul	do	86	7	
Czechoslovakia				Oct.-Dec., 1923: Cases, 21. Mar. 1-31, 1924: Cases, 30; deaths, 2.
Danzig-Polish frontier:				
Mühlbanz	Mar. 6			Present: Origin stated to be focus at Mallinia.
Ecuador:				
Quito	Nov. 1-30	14	1	
Egypt:				
Alexandria	Nov. 19-Dec. 23	3		
Do	Jan. 8-Apr. 1	7		
Cairo	Sept. 10-Dec. 31	39	11	
Do	Jan. 8-Feb. 4	5	3	
Esthonia				Nov. 1-30, 1923: Paratyphus fever, cases, 8. Dec. 1-31, 1923: Typhus fever, cases, 15; paratyphus fever, cases, 4. January 1-Mar. 31, 1924: Cases, 11; paratyphus fever, cases, 21.
Finland				Dec. 1-15, 1923: Paratyphus fever, cases, 15. Feb. 15-Mar. 31, 1924: Paratyphus fever, cases, 12.
Germany:				
Coblenz	Jan. 27-Feb. 2	1		
Greece:				
Athens	Jan. 11-Feb. 20		7	
Saloniki	Nov. 26-Dec. 30	7	3	
Hungary				July 1-Aug. 31, 1923: Cases, 24.
Budapest	Jan. 27-Apr. 19	35	13	
Java:				
East Java—				
Soerabaya	Dec. 9-29	12		
Do	Dec. 30-Jan. 5	2		
Latvia				Oct. 1-Dec. 31, 1923: Cases, 22. Paratyphus fever, 12; recurrent typhus, 3. Jan. 1-Mar. 31, 1924: Cases, 132. Paratyphus,

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Latvia—Continued.				
Libau	Apr. 8–15	4		A. 1: B. 1. Recurrent, 1 case.
Lithuania				Year, 1923: Cases, 819; deaths, 86; recurrent typhus, 13 cases. Feb. 1–Mar. 31, 1924: Cases, 289; deaths, 27.
Mexico:				
Durango	Dec. 1–31		2	
Do	Jan. 1–Feb. 29		3	
Guadalahara	Jan. 27–May 10	5	9	Feb. 1–29, 1924: Cases, 2; deaths, 1.
Mexico City	Nov. 25–Dec. 29	86		Including municipalities in Federal district.
Do	Dec. 30–Apr. 19	90	8	
San Luis Potosi	Jan. 17–23		1	
Torreon	Feb. 1–Mar. 31		6	
Netherlands:				
Amsterdam	Mar. 2–Apr. 26	4		
Norway:				
Stavanger	Dec. 25–31	1		
Palestine:				
Jaffa	Jan. 1–Apr. 15	7		
Jerusalem	Feb. 19–May 5	4		
Persia:				
Teheran	Sept. 24–Oct. 23		1	
Poland				Sept. 23–Dec. 31, 1923: Cases, 947; deaths, 92; recurrent typhus, cases, 67; deaths, 1. Jan. 1–Feb. 9. 1924: Cases, 1,232, deaths, 102. Recurrent cases, 63. Jan. 6–Feb. 2, 1924: Cases, 341; deaths, 26. Recurrent fever, cases, 27.
Pomerellen	Jan. 8–Mar. 25	17	4	Locality on Danzig-Polish frontier.
Portugal:				
Oporto	Jan. 27–Feb. 2	2		
Rumania:				
Kishineff district	Nov. 1–Dec. 31	15		
Russia:				Reported present in various sections, Mar. 12, 1924.
Karelian Republic	Mar. 12			Prevalent.
Novo Cherkarsk	do			Do.
Rostov-on-Don	do			Do.
Saratov	do			Aug. 1–Sept. 30, 1923; Cases, 768. Recurrent typhus: Cases, 2,307.
Ukraine				
Siberia:				
Vladivostok	Feb. 19			Present and verging on epidemic prevalence.
Spain:				
Barcelona	Nov. 29–Dec. 12		2	
Do	Jan. 3–Apr. 2		6	
Madrid	Dec. 1–31		7	
Do	Jan. 1–31		2	
Syria:				
Damascus	Jan. 27–Feb. 2	1		
Tunis:				
Tunis	Feb. 5–11	1		
Turkey				Dec. 1–31, 1923: Cases, 41; deaths, 5.
Constantinople	Nov. 11–Dec. 29	15	1	
Do	Dec. 30–Apr. 5	11		
Union of South Africa				Oct. 1–31, 1923: Colored, 287 cases, 58 deaths; white, 2 cases; total, 289 cases, 58 deaths. Jan. 1–Feb. 29, 1924: Cases, 407; deaths, 75 (colored). Among white population, 7 cases. Total cases, 414; deaths, 75.
Cape Province				Oct. 1–31, 1923: Colored, cases, 245; deaths, 47.
Do				Jan. 1–Feb. 29, 1924: Cases, 168; deaths, 26. Feb. 24–Apr. 12, 1924: Outbreaks.
Natal				Oct. 1–31, 1923: Colored, cases, 4; deaths, 3.
Do				Jan. 1–Feb. 29, 1924: Cases, 90; deaths, 14. Feb. 24–Mar. 1, 1924: Outbreaks.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 29, 1923, to June 13, 1924—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Union of South Africa—Cont'd.				
Durban	Nov. 24–Dec. 1	73		Cases occurring among native stevedores in the harbor area of the port and confined to one barracks.
Orange Free State				Oct. 1–31, 1923: Colored, cases, 25; deaths, 8. Feb. 24–Mar. 1, 1924: Outbreaks.
Do				Jan. 1–Feb. 29, 1924: Cases, 59; deaths, 10. Mar. 23–Apr. 5: Outbreaks.
Kroonstad District	Jan. 20–26			Outbreaks on 2 farms.
Transvaal				Oct. 1–31, 1923: Colored, cases, 13.
Do				Jan. 1–Feb. 29, 1924: Cases, 90; deaths, 26.
Johannesburg	Oct. 1–Dec. 31	3	4	
Do	Jan. 6–Mar. 29	8		
Potschefstrom District	Jan. 20–26			Outbreaks on 7 farms.
Venezuela:				
Maracaibo	Dec. 16–22		1	
Do	Feb. 17–May 3		8	
Yugoslavia:				
Croatia—				
Zagreb	Dec. 2–15	3		
Do	Feb. 17–23	1		
Serbia—				
Belgrade	Nov. 25–Dec. 1	1		
On vessel:				
S. S. Malta Maru	Mar. 17	1		At Rotterdam, Netherlands, from South America.

YELLOW FEVER.

Brazil:				
Pernambuco City	Nov. 16, 1923	3	2	
Do	May 26, 1924			Reported present.
West Africa (French Dahomey):				
Porto Novo	May 26			Present.